Transport Certification
Update
Certification Information for
the Aviation Industry and Designees
Edition 19, Summer 1995

The New Boeing Model 777

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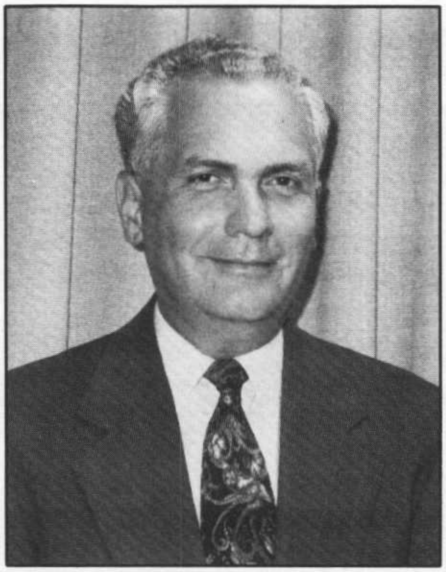
From The Directorate Manager . . .

With this issue, the Transport Airplane Directorate introduces a new publication that replaces our previous **Designee Newsletter**.

As the effect of our work in this Directorate has reached more global proportions, and based on feedback received from our customers, we have identified the need to get certification information to a much wider audience than was previously served by the **Designee Newsletter**. Many of our non-designee customers who have had access to the **Newsletter** have told us that there are few other sources to go to in order to find the type of information usually contained in that publication.



Ronald T. Wojnar

Seeing this obvious need to provide information, we have developed the **Transport Certification Update**. Distribution of this publication will reach a wide audience: not only designees, but aviation manufacturers and suppliers, industry representatives, and foreign aviation officials, as well. Although we intend to continue to provide information that will be of particular interest to designees, the **Update** will contain articles intended to keep the aviation industry-at-large informed of pertinent issues relevant to our certification projects and related subjects.

We hope that the **Update** will serve as one medium for creating and maintaining a good communication system with our customers. I invite you to contact the Editor of the **Update** to express your opinions, request additional information, suggest improvements, and share your accomplishments with us. Take advantage of this opportunity and let us hear from you.✠

Ronald T. Wojnar

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Transport Certification

Update

Certification Information for the Aviation Industry and Designees

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The purpose of the Transport Certification Update is to provide the aviation community -at-large and designees with the latest information concerning regulations, guidance material, policy and procedure changes, and personnel activites involving the certification work accomplished within the FAA Transport Airplane Directorate's jurisdictional area. Although the information contained herein is the latest available at press time, it should not be considered "authority approved," unless specifically stated; neither does it replace any previously approved manuals, special conditions, alternative methods, or other materials or documents. If you are in doubt about the status of any of the information addressed, please contact your cognizant Aircraft Certification Office (ACO), Manufacturing Inspection District Office (MIDO), or other appropriate FAA office.

Cover story

Boeing 777 Type Certificated

Boeing Model 777

The new Boeing Model 777 jetliner earned unprecedented certifications from the FAA and the Joint Aviation Authorities (JAA) for both the airplane's design and production. The FAA issued a production certificate and, together with its European counterpart — the European JAA, which comprises the aviation regulatory authorities of 18 countries — issued a type-design certificate on April 19, 1995, formally acknowledging that Pratt & Whitney-powered aircraft has met the latest safety requirements.

"Achieving FAA and JAA type-design jointly and production certification is an historic milestone for The Boeing Company and an unparalleled achievement in the history of commercial aviation," stated **FAA Administrator David Hinson** at a planeside ceremony in Everett, Washington. "The program itself marks a new way of certifying aircraft and incorporates the 'Working Together' concept that has been the basis of the 777 program."

General Description

The 777's fuselage has a diameter of 20 feet 4 inches — a wider body than any other jetliner except the Boeing 747. The 777's interior cross-section is at least 5 inches more than current wide-body tri-jets, affording more "comfort space" to trade between seat width, aisles, and seat pitch. The 777 can be configured in any combination of seating arrangements, ranging from six seats to 10 seats abreast with two aisles.

With an overall length of 209 feet 1 inch, the initial 777 will offer two-class seating for 375 to 400 passengers, or three-class seating for 305 to 328 passengers. In an all-economy configuration, the airplane will seat as many as 440 passengers.

The airplane has a standard maximum takeoff weight of 506,000 pounds and range capability of up to 4,350 statute miles. The structural capability of the initial airplane allows two optional maximum takeoff weights of 515,000 pounds or 535,000 pounds. The first option allows a range of up to 4,670 statute miles; the second option permits a range of up to 5,330 statute miles.

Wing Design

The 777's wing, in further refinement of designs introduced on the Boeing 757 and 767, features a long span with increased thickness while achieving higher cruise speeds. This advanced wing enhances the airplane's ability to climb quickly and cruise at higher altitudes than competing airplanes. It also allows the airplane to carry full passenger payloads out of many high-elevation, high-temperature airfields.

Propulsion

Fuel volume requirements for the 777 are accommodated entirely within the wing and its structural center section. For the initial A-Market airplane, fuel capacity is 31,000 gallons, while the longer-range, B-Market model will carry up to 44,700 gallons.

The 777 wing has an optional feature that introduces to commercial aviation a concept that has been common on naval aircraft for decades: A hinge and actuation mechanism enables about 22 feet of each wingtip to fold upward, reducing the wingspan to about 155 feet when the airplane is on the ground.

Pratt & Whitney (PW4000 series engines), General Electric (GE90 series engines), and Rolls-Royce (Trent 800 series engines) are developing more efficient and quieter turbofans to power the 777. For the initial A-Market airplane, these engines are rated in the 74,000 to 77,000 pound thrust class. For the longer-range B-Market model, these same engines will be capable of thrust ratings in the 84,000 to 90,000-pound category. The engines could be developed to even higher thrust ratings, depending on future payload and range requirements.

All three makes will be more powerful than current engines, and will offer excellent fuel efficiency while allowing the 777 to be as quiet as a 767, even though the 777 engines will provide 40 percent more power. Key factors in this performance are new, larger-diameter fans with wide-chord fan blade designs and bypass ratios ranging from 6-to-1 to as high as 9-to-1. This compares to the typical 5-to-1 ratio for the engines of today's wide-body jets.

Materials

New, lightweight structural materials are used in several 777 applications. For example, an improved aluminum alloy is used in the upper wing skin and stringers. Known as 7055, this alloy offers greater compression strength than current alloys, enabling designers to save weight and also improve corrosion and fatigue resistance.

Progress in the development and fabrication of weight-saving advanced composite materials is evident in the 777. Carbon fibers embedded in recently available toughened resins are found in the vertical and horizontal tails. The floor beams of the passenger cabin also are made of these advanced composite materials.

Flight Deck and Airplane Systems

The 777's flight deck is a horizontal format similar to that of the 747-400. Principal flight, navigation and engine information is presented on six large display screens.

Although these displays resemble conventional cathode ray tube, or CRT, screens, they incorporate advanced liquid-crystal display technology. The depth of the new "*flat panel displays*" is about half that of CRT's. In addition to saving space, the new displays weigh less and require less power. They also generate less heat, which contributes to greater reliability and a longer service life. Another benefit: they do not require the heavy, complex air conditioning apparatus needed to cool equipment on current flight decks. Pilots appreciate that flat panel displays remain clearly visible in all conditions, even direct sunlight.

Three multipurpose control display units (CDU) installed in the center aisle stand provide data display and entry capabilities for flight management functions and are the primary interface with an integrated Airplane Information Management System (AIMS). The CDU's have color displays, which allow pilots to assimilate the information more quickly.

AIMS will provide flight and maintenance crews all pertinent information concerning the overall condition of the airplane, its maintenance requirements and its key operating functions, including

Continued on page 54

MD-90 Type Certification

McDonnell Douglas Model MD-90

Certification of the McDonnell Douglas Model MD-90 twinjet on November 4, 1994, was the culmination of five years of concentrated design and development effort involving thousands of FAA, McDonnell Douglas, and supplier employees.

McDonnell Douglas President and CEO **Harry Stonecipher**, and Douglas Aircraft Company President **Robert Hood**, accepted the MD-90 Type and Production Certificates from FAA Deputy Administrator **Linda Daschle** and Secretary of Transportation **Federico Peña** in a planeside ceremony in Washington, DC. Award of the Type and Production Certificates by the FAA allowed McDonnell Douglas to begin delivery of the MD-90. The first deliveries were to Delta Air Lines in February 1995. The MD-90 began revenue service with Delta in April 1995.

The MD-90, a successor of the DC-9 and MD-80, will extend the successful Douglas twin-jet line into the next century. As of April 1, 1995, Douglas has commitments for 148 MD-90's from six customers - Delta Air Lines, Japan Air Systems, Scandinavian Airlines System, China-CATIC, and Great China.

The MD-90 is equipped with International Aero Engines V2500-D5 high bypass ratio turbofan engines to meet the primary design goals of reducing noise and emissions. The FAA certification noise testing showed that the MD-90 is the quietest large aircraft jet transport, with cumulative noise levels 25 dB below the ICAO Stage 3 limits.

In addition to the engine change, a new auxiliary power unit (the Garrett GTCP131-9D), a new hydraulically powered elevator control system, new VSCF electrical system, new carbon brakes with digital anti-skid, vacuum lavatories, and a new interior were part of the MD-90 configuration certificated.

The MD-90 program was launched in November 1989. Fabrication of the first part began in February 1991, and assembly of the first airplane began in February 1992. The first flight of the MD-90 occurred on February 22, 1993.

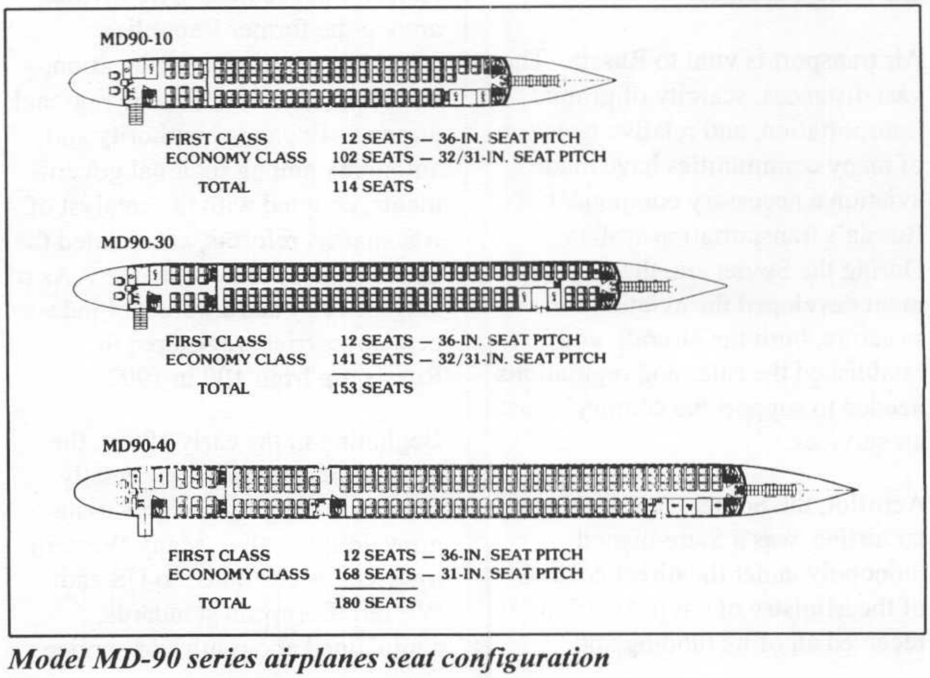
In all, nearly 2,000 hours of flight testing were conducted in 1,500 flights from first flight to certification. Two flight test aircraft were used for the bulk of the certification testing program, plus a short test program for function and reliability evaluations on the first production aircraft.

Some of the interesting statistics from the flight test program include:

- 8,000 data parameters were recorded with 4,000 parameters recorded simultaneously.
- 50 miles of instrumentation cable used on the test aircraft.
- 1,800 miles of onboard data tape collected.
- The flight test aircraft averaged 55 flight hours per month.
- 18 Type Inspection Authorization (TIA) supplements were issued by the FAA. The TIAs were time phased to allow FAA participation from the beginning of the flight test program rather than completing development testing and then inviting the FAA to participate. This made for a more efficient flight test program.
- 19 separate flights were accomplished in one day in October 1994, during function and reliability testing.
- The fire detection and extinguishing system was demonstrated in flight. This was the first time this has been conducted as a flight test. Previous demonstrations have been conducted on the ground.
- The test aircraft was taken to the Paris Air Show and on a tour of six European cities in the middle of the flight test program. The aircraft achieved 100% dispatch reliability during the tour even at this early stage in the aircraft's development.
- The test aircraft visited 40 cities (runways) during the test program. More than 600 autolands were flown at 15 airports. Other test sites included icing tests in Alaska; wet runway braking and water ingestion at Glasgow, Montana, and Yuma, Arizona; and rejected takeoff braking at Roswell, New Mexico, and Edwards Air Force Base.

Excellent teamwork between Douglas and the FAA was one of the highlights of the flight test and certification program. This teamwork allowed the achievement of the Type and Production Certificates two weeks ahead of the scheduled date. Also, *the aircraft* type certification included autoland category 3a and flight management system (FMS) approval. This may be the first time that this has been accomplished for a new aircraft or derivative with the magnitude of changes of the MD-90.

Also significant was the approval of the MD-90 with the same pilot type rating as the MD-80. This was an important program objective in order to minimize flight crew training and allow crews to transition easily from their MD-80 aircraft. This requirement presented the designers with a challenge of incorporating as many improvements as possible with a design that did not require too much additional training. For example, the hydraulically powered elevator characteristics were tailored to match the MD-80 as closely as possible so that handling qualities were not altered to an extent that would cause the FAA to require simulator training to meet FAR qualification. ✠



Model MD-90 series airplanes seat configuration

Russian Civil Aviation System Safety Evaluation

For more than two years, as Russia has been evolving to a market economy, aviation officials from Russia's Department of Air Transport (DAT), the Russian Commission for Air Traffic Regulation (ROSAERONAVIGATSIYA), and America's Federal Aviation Administration (FAA) have been working together to share information regarding their civil aviation systems. Building on past accomplishments of this and other groups, a team of American aviation specialists recently visited Russia at the invitation of the Russian Minister of Transportation to participate in an unprecedented, cooperative safety evaluation of the Russian civil aviation system. The purpose of this report is to present the findings of the joint evaluation of Russian civil aviation system safety oversight.

Background

Air transport is vital to Russia. The vast distances, scarcity of ground transportation, and relative isolation of many communities have made aviation a necessary component of Russia's transportation system. During the Soviet era, the government developed the aviation infrastructure, built the aircraft, and established the rules and regulations needed to support the country's vast air services.

Aeroflot, the Soviet Union's singular airline, was a State-owned monopoly under the direct control of the Ministry of Civil Aviation. It received all of its funding and support from the State, and because of government subsidies, offered affordable travel for the average Soviet citizen. With the dissolution of the Soviet Union came radical changes. The tumultuous environment witnessed on the political stage was mirrored in the aviation community. Within a very short period of time, the centralized structure of the Soviet's Ministry of Civil Aviation and the State Supervisory Commission for Flight Safety (Gosavianadzor) was divided between a number of principal authorities including DAT and ROSAERONAVIGATSIYA under the Ministry of Transportation, and the Interstate Aviation Committee of the Commonwealth of Independent States (CIS). This realignment generated much uncertainty over civilian aviation roles and responsibilities in Russia.

Upon dissolution of the USSR, Aeroflot's resources were divided among the former Republics according to geographic location, and also subdivided among regional airports. Expanded authority and autonomy among regional governments, coupled with the catalyst of free market reforms, accelerated the establishment of new airlines. As of August 1994 there were 394 independent carriers registered in Russia, up from 100 in 1992.

Beginning in the early 1990s, the number of foreigners, especially Westerners, flying within Russia grew dramatically. Many Western travelers, accustomed to US and Western European standards, complained about inferior service, long delays, antiquated airport facilities, poor conditions of aircraft interiors, and indifference to cabin safety issues aboard Russian carriers. Coinciding with these complaints, Russian civil aviation experienced a series of highly publicized accidents. This combination of customer dissatisfaction and increase in air accidents fueled numerous media reports critical of the Russian air transport system. Many reports, especially those based largely on customer complaints, focused more on subjective perceptions of safety rather than objective measures of safety.

At the peak of media attention, DAT was in the process of establishing its regulatory authority over the civil aviation industry. The increased attention placed on DAT made efforts to stabilize their authority more complex and their mission more urgent. The joint System Safety Evaluation described in this report represents one of the actions which DAT is taking to address civil aviation safety within a resource constrained environment.

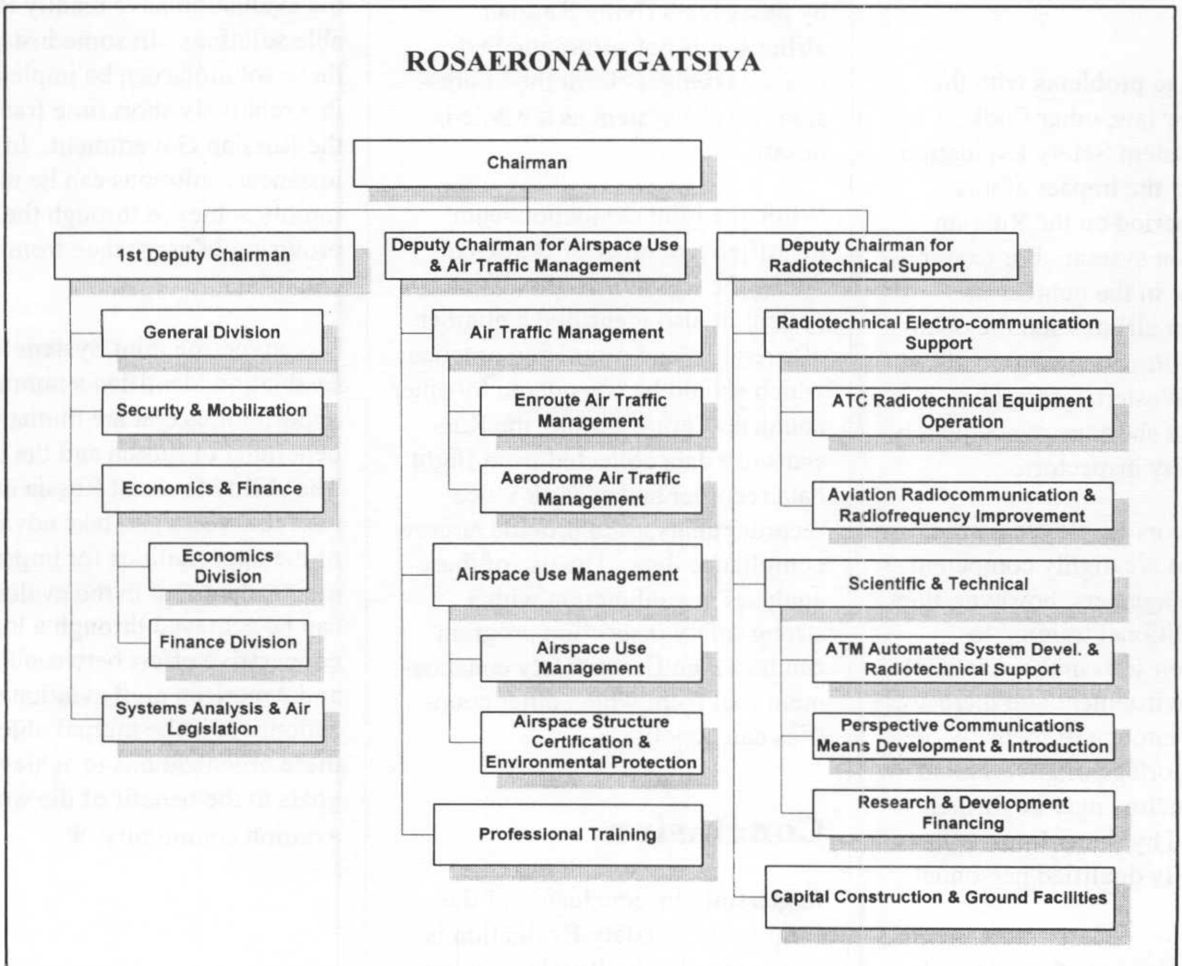
Joint System Safety Evaluation

To conduct the joint Russian/American Civil Aviation System Safety Evaluation, American team members traveled to Russia in August 1994. The participants in the evaluation (Russian and American) were agreed upon by both governments prior to travel, as were the goals and schedule of activities. The current evaluation focused on primary governmental facets of the Russian air safety system that impact most directly and dynamically on the operation of air carriers. Upon arrival in Moscow, there were two days of general briefings by senior DAT and ROSAERONAVIGATSIYA officials. Following the general briefings, the Russian/American team broke into five groups. The groups included specialists representing aviation law, flight standards, continued airworthiness, air traffic, and accident investigation. The groups traveled to ten cities across Russia to visit DAT Regional Administrations, Russian training facilities, airlines, maintenance and repair facilities, air traffic control facilities, and other aviation entities. A summary of the findings and conclusions of the joint Russian/American team is provided below.

Summary of Findings

The joint System Safety Evaluation revealed a civil aviation system in a state of massive transition. The authorities responsible for oversight of civil aviation are attempting to complete this transition while avoiding progressive deterioration of the existing system. Certain aspects of this transition are conceptually similar to the period of deregulation of the US airlines, however the speed and magnitude of change occurring in the Russian civil aviation system far outstrips that experienced in the US during the 1980s. Of greater importance is the fact that the changes underlying the transition of the Russian civil aviation system are a direct result of basic changes in the national political and economic environment in which this transportation system operates.

Many of the problems identified in the System Safety Evaluation reflect these societal changes and their impact, rather than inherent weaknesses in the civil aviation system itself. The civil aviation system operating within the former Soviet Union was founded on an Air Code which clearly established the legal and regulatory authorities for various government organizations involved in civil aviation. That Air Code, however, is inadequate to provide for the organizational



empowerment and complete authority necessary to oversee the Russian civil aviation industry as it evolves into a market-oriented structure. With the dissolution of the Soviet Union, Russia has faced the task of instituting an entirely new legal basis for civil aviation regulation at the same time that the government structure was in a state of major transition. Not surprisingly, the proposed new air law lacks the degree of specificity of roles and responsibilities of the governmental aviation organizations that is ultimately desirable for a civil aviation system operating within a free market economy. Ministry of Transportation officials recognize these problems and are in the process of clarifying the roles and responsibilities of civil aviation organizations within the Russian Federation.

In addition to problems with the proposed air law, other findings of the joint System Safety Evaluation team reflect the impact of this transition period on the Russian civil aviation system. For example, the increase in the number of independent airlines and the opening of the Russian system to allow the use of Western aircraft has resulted in a shortage of adequately trained safety inspectors.

The inspectors employed by the government are highly competent pilots and engineers, however, they require additional training to perform their jobs in the new civil aviation environment and there are simply not enough of them. Moreover, the shortage of government safety inspectors may be further exacerbated by the airlines' efforts to hire highly qualified personnel from DAT.

A critical shortage of resources is also responsible for many of the problems identified within the area of air traffic control. These problems included the need for increased English language training of air traffic controllers and requirements for modernization or repair of aging equipment and facilities.

The systematic observations and interviews conducted by the System Safety Evaluation team did not confirm the anecdotal evidence of widespread and consistent instances of forced overboarding and overloading of aircraft that has recently been reported in newspapers and periodicals. However, the team did observe a pervasive and persistent negligence of enforcement of cabin safety regulations on the part of Russian flight crews. Since this is one area of safety readily observed by passengers flying Russian airlines, it is not surprising that many passengers form the impression that the system as a whole is unsafe.

While the joint evaluation team identified a number of challenges facing the Russian civil aviation system, it also identified a number of strengths and promising practices which should be considered by other countries. For example, the Russians use data collected from flight data recorder and cockpit voice recorder analyses to provide aircrew compliance data. The use of these analyses in conjunction with a strong safety inspection program can be a significant safety enhancement tool from which other countries can benefit.

Conclusion

In general, the conclusion of the Joint System Safety Evaluation is that currently, the Russian Government minimally meets ICAO standards for safety oversight of the civil aviation system. However, this level of safety cannot be maintained or enhanced without the Russian Government taking certain actions in the near future.

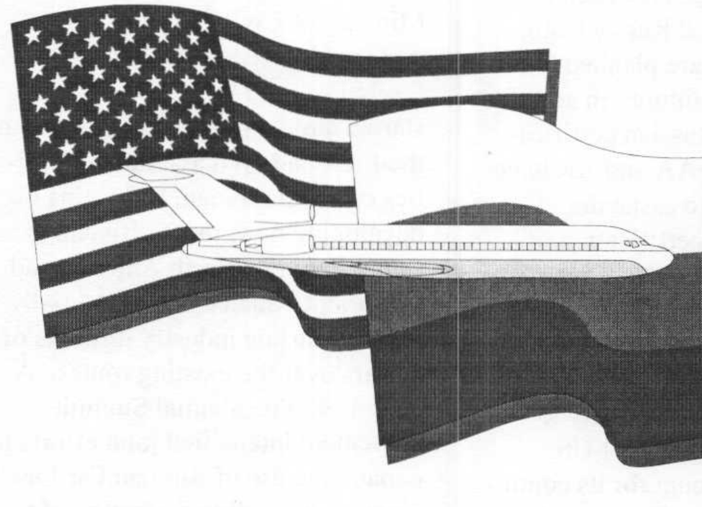
The problems identified by the team and the continued movement toward a free market environment demand immediate implementation of the major recommendations contained in this report. Failure to take swift action will almost certainly result in a degradation of safety to a level below minimally acceptable international standards.

Perhaps the most important conclusion reached by the joint system safety evaluation team is that a number of the problems revealed by the evaluation have readily identifiable solutions. In some instances, these solutions can be implemented in a relatively short time frame by the Russian Government. In other instances, solutions can be most rapidly achieved through the provision of assistance from other countries.

Moreover, the joint System Safety Evaluation identified a number of opportunities that are mutually beneficial to Russia and the US. The ability to assist Russia over the next few years and take advantage of the opportunities for improvements identified in the evaluation can be achieved through a long-term cooperative effort between Russian and American civil aviation organizations. It is the mutual objective of these organizations to achieve these goals to the benefit of the world aviation community. ✠

Cooperative Efforts Between the US and Russia

The System Safety Evaluation conducted during the period from August 15 to September 15, 1994, was preceded by many cooperative efforts between Russia and the US. The following sections describe efforts completed prior to the current System Safety Evaluation.



Flight Standards

Policy-level and technical officials of DAT, FAA, and ROSAERONAVIGATSIYA met from February 6 through 18, 1994, at the FAA's Center for Management Development. The purpose of the conference was to establish closer Russia/US working relationships on important civil aviation safety matters. During the conference, DAT and FAA officials gave detailed briefings on their respective structures and approaches for assuring the highest practicable safety in domestic and international civil aviation operations. Visits were made to a nearby FAA operational level flight safety office; a large, privately operated flight training center; and a major, privately owned US aviation university. Technical discussions during the meeting sessions and facility visits enabled DAT representatives to gain a better understanding of how the FAA approaches aviation safety regulation in an established free market economy. The discussions also allowed FAA representatives to learn how DAT approaches aviation safety regulation as Russian civil aviation transitions into a free market civil aviation system with competitive airlines, commercial aviation organizations, private airports, and a growing general aviation sector.

DAT and FAA participants agreed that the conferences achieved its intended purpose. Moreover, the growth in air travel and in overall civil aviation relations between Russia and the US was determined to be an important reason to continue to build upon this significant advance in relations between the two aviation safety authorities. Conferences participants also noted that technical side agreement to the 1994 US/Russian Air Transport Agreement was signed by the US Department of Transportation and the Russian Ministry of Transportation at a then recently held summit meeting between **Presidents Clinton and Yeltsin**. Based upon the progress made during the conference and the new technical side agreement, the conferences participants decided to form a small and efficient US/Russian aviation safety working group with the aim of meeting approximately twice yearly to foster improved international aviation safety working group with the aim of meeting approximately twice yearly to foster improved international aviation safety. This evaluation was an extension of the type of cooperation envisioned by the working group.

Continued Airworthiness

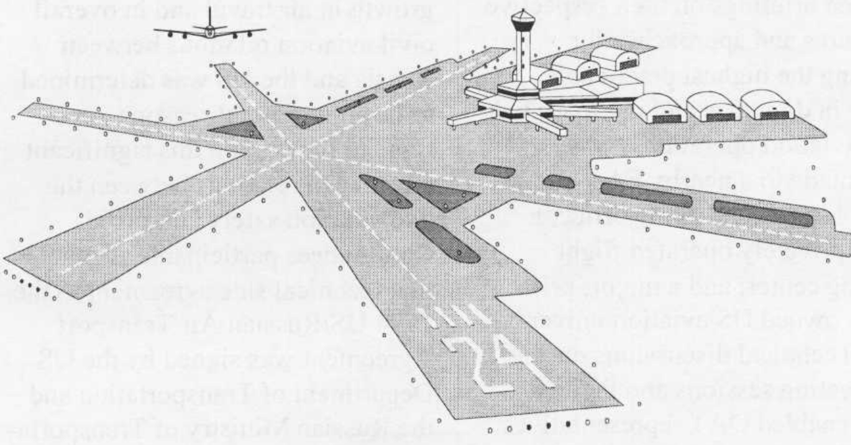
Discussions between the former USSR's GAN and the FAA regarding increasing cooperation in aircraft certification activities began in June 1990. In December of that year, the US Department of State received a Soviet diplomatic note requesting a USSR/US bilateral airworthiness agreement (BAA). The technical process leading to a BAA began in 1991. Since that time, the FAA has been engaged in continuing cooperative efforts with MAK AR, which is the designated airworthiness organization for the Russian Federation. These efforts included technical visits regarding aircraft for which the Russians applied for type certification. In addition, FAA officials visited Russia to review the Russian aircraft design and certification process. Meetings have been held often in the US and Russia beginning in 1991 and are planned to continue into the future. In addition to assessing the Russian certification system, the FAA and AR have worked together to assist the Russians in their certification of numerous US products. Toward this end, FAA and AR have concluded two sets of working procedures. The first describes each organization's responsibility to facilitate the validation of US products and account for its continued airworthiness. The second procedure establishes requirements for Russian approval of US components to be installed on various aircraft in the CIS.

Air Traffic

Working relations between the Ministry of Civil Aviation of the former Soviet Union and the FAA Air Traffic Division started at the FAA Alaskan Region. This was the result of a "friendship flight" from Magadan to Anchorage on Aeroflot in March 1988 in which the Ministry of Civil Aviation Magadan Regional Administrator met with the FAA Alaskan Region Air Traffic Division Manager. As a result of this meeting, the Alaskan Region assembled a team of air traffic experts who visited the Soviet Far East and began what is today a very strong working relationship. This resulted in conclusion of a Memorandum of Cooperation between the FAA and the USSR Ministry of Civil Aviation in February 1990 which provided the framework to establish international airways and exchange air traffic between the two countries.

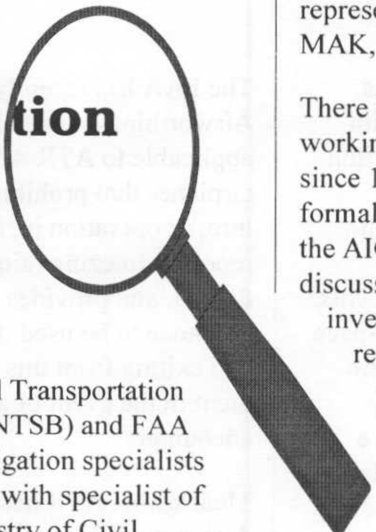
In the past six years much has been accomplished between the FAA air traffic organization and the former Ministry of Civil Aviation, now replaced by ROSAERONAVIGATSIYA and DAT. Discussions started almost immediately between the FAA and civil aviation authorities of Russia, Japan, and China on developing new, more efficient routes between North America and the Orient. Such routes potentially save the airline industry millions of dollars over the existing routes. A June 1992 Presidential Summit agreement intensified joint efforts to expand the use of Russian Far East airspace, including formation of a joint FAA and ROSAERONAVIGATSIYA team of experts who traveled and assessed air traffic services in the Russian Far East for the purpose of opening the new international routes. Because extensive work was required to open these routes, the FAA and ROSAERONAVIGATSIYA jointly formed an informal planning group called the Russian/American Coordinating Group for Air Traffic Control (RACGAT). RACGAT brought the provider states of Russia, the US, Japan, and China, together with international air carrier representatives, to jointly work on developing an air traffic service plan for the Russian Far East. RACGAT meets twice a year.

In a related development, member airlines of the US Air Transport Association funded English language training for 75 Russian Far East air traffic controllers. This training was conducted to facilitate the opening and expansion of new routes through the Russian Far East. The FAA air traffic organization, with the help of the Air Transport Association, also developed an air traffic controller exchange program in which Russian and Alaskan Region controllers live in each other's homes on a two week exchange, learning the way each other provides air traffic services. There have also been numerous trips by representatives from Magadan, Anadyr, Khabarovsk, Yuzhno-Sakhalinsk, and Petropavlovsk-Kamchatsky to Alaska to observe how the FAA controls air traffic. The US Trade and Development Agency has funded an 11.3 million dollar effort, monitored by ROSAERONAVIGATSIYA, to identify and develop a competitive procurement package



for modernizing the air traffic management system in the Russian Far East.

Accident Investigation



Senior National Transportation Safety Board (NTSB) and FAA accident investigation specialists met informally with specialist of GAN, the Ministry of Civil Aviation, and the Ministry of Aviation Industries in 1987 and 1988, during annual seminars of the International Society of Air Safety Investigators (ISASI), to discuss issues of mutual concern. The productivity of those exchanges was limited and pertained primarily to discussions about the potential for major investigations involving Aeroflot in the US and US airlines and aircraft in the Soviet Union. The respective States' procedures related to compliance with ICAO Annex 13 were also discussed at these meetings of senior investigators.

Since May 1989, when a US/USSR transportation cooperative agreement was signed, the US has had a close working relationship with officials of GAN, the Ministry of Civil Aviation Industries, and GOSNIIGA, and, since 1991, with MAK and DAT. The Accident Investigation Group (AIG) formed as part of the 1989 agreement was originally made up of senior NTSB, FAA, GAN, Ministry of Civil Aviation, and Ministry of Aviation Industries technical accident investigations specialists. Following the formation of MAK, the cooperative exchanges continued and included representatives of the NTSB, FAA, MAK, and DAT.

There have been eight formal working group meetings of the AIG since 1989, and several other less formal technical exchanges. During the AIG meetings, representatives discussed contingency plans for investigations involving the respective States' interests, and investigative and accident prevention techniques and methods. In addition, they met with manufacturing and airline safety representatives from each State. Several cooperative activities have taken place and several significant, mutually beneficial accomplishments have resulted from these exchanges.

The AIG specialists worked closely to develop an agenda for and resulting recommendations to the ICAO Council for the 1992 Accident Investigation Divisional Meeting (AIG/92). MAK led the delegation that represented the Russian Federation during AIG/92 and worked closely with the NTSB to develop a consensus position on improving the content of Annex 13 and other relevant accident investigation and prevention initiatives at ICAO.

Additionally, in 1993, the NTSB worked closely with technical aviation safety specialists from MAK and DAT during the ICAO-led reopened investigation of the downing of Korean Airlines (KAL) Flight 007 in 1983.

Other Cooperative Efforts

In addition to the efforts described above, a number of other projects and ongoing, cooperative efforts are underway between the US, Russia, and other countries around the world.

For example, Russia and the US have reestablished cooperation on the US Global Positioning System (GPS) and Russian Global Orbiting Navigational Satellite System (GLONASS). Both countries have agreed to coordinate their efforts in ICAO to expedite worldwide implementation of the satellite-based communication, navigation, and surveillance air traffic management system using civil signals from GPS and GLONASS.

Another example of joint efforts between Russia and the US is the program being conducted by Rockwell International, Hughes, and the Russian GosNIAS Institute under Nunn-Lugar funding.

Still other projects that the FAA has supported include a Booz-Allen Hamilton, Russian Far East modernization and specification project, the coproduction of civil secondary surveillance radar by Westinghouse and All-Union Scientific Research Institute of Radio Equipment (AUSRIRE), an Ilyushin Design Bureau financial study, and others. These projects were supported by the Trade Development Agency. In conjunction with the Agency for International Development, FAA has assisted in efforts such as joint US/Russian civil aviation technical and safety training.

Investigation into Ice Protection for Freezing Rain/Freezing Drizzle

A recent accident has raised the concern that aircraft operating in certain meteorological conditions can accrete ice aft of the protected area of the wing, which may result in lateral control difficulties due to disturbed flow over the aileron. This flow separation may cause unexpected control forces which the flightcrew has difficulty countering. The meteorological conditions encountered by the airplane involved in the accident are believed to be outside the conditions defined in the Federal Aviation Regulations (FAR) part 25, Appendix C.

The FAA's Aircraft Certification Offices (ACO) have been requested to take certain actions with the manufacturers within their geographical area of responsibility, who build part 23 and part 25 airplanes that are equipped with pneumatic deicing boots and non-powered flight control systems, and operate under parts 121 and 135 of the FAR. These actions are intended to determine susceptibility of these airplanes to control difficulties following operation in freezing rain or drizzle that could result in an unsafe condition. If such a condition is found to exist, prompt corrective action will be taken.

Background

On October 31, 1994, a Simmons Airlines Aerospatiale Model ATR-72-210, operating as Flight #4184, crashed near Roselawn, Indiana. The FAA has been working with Aerospatiale, the French Direction Générale de L'Aviation Civile (DGAC), the Direction des Constructions Aéronautiques, the French Bureau Enquetes Accidents, the National Aeronautics and Space Administration (NASA), and the National Transportation Safety Board (NTSB), in a cooperative effort to determine the probable cause of the accident.

While the NTSB has not yet issued its formal findings, testing performed in France, and using a United States Air Force icing tanker at Edwards Air Force Base in California, have led the FAA to believe that the large droplet size and high liquid water content conditions (associated with freezing rain/freezing drizzle, and hereinafter called large supercooled droplets), believed to have been present in the vicinity of Flight 4184, may have resulted in ice formation on the upper surface of the wing aft of the area protected by the deicing boots. Based on ATR and FAA testing conducted so far, an ice shape similar to a length of quarter-round molding may have formed aft of the protected area of the wing and forward of the aileron on the accident airplane. The FAA believes that this ice accumulation may have caused an air flow disturbance over the ailerons, which in turn resulted in uncommanded aileron movement and airplane roll.

The FAA has recently issued an Airworthiness Directive (AD) applicable to ATR-42 and ATR-72 airplanes that prohibits dispatch into, or operation in, known or reported freezing rain or freezing drizzle, and provides interim guidance to be used in identifying and exiting from this icing environment in the event of an inadvertent encounter.

Meanwhile, ATR has developed a design modification that will extend the area protected by the de-icing boots beyond the region where ice can accrete when operating in the atmospheric conditions believed to have existed in the vicinity of the Roselawn accident.

New Design Review Effort

The FAA's Aircraft Certification Service is concerned that other airplanes may be subject to the possible control phenomena exhibited on the accident airplane. Although large supercooled droplets are outside of the icing environment characterized in Appendix C, they are a phenomenon encountered in service, especially at altitudes typical of turboprop operation. The FAA has identified susceptibility to loss of control following exposure to large supercooled droplets as an unsafe condition which may exist on other airplanes. Section 21.99 of the FAR notes that the manufacturer must develop appropriate design changes when the FAA Administrator determines that an unsafe condition exists for specific airplanes.

The ACO's will be contacting the manufacturers within their areas of responsibility, who build part 23 and part 25 airplanes equipped with pneumatic boots and non-powered flight control systems, and requesting that those manufacturers examine their designs to determine if they are susceptible to this same phenomena.

On the ATR-72 airplane, ice appears to develop aft of the active portion of the boots only when operating in large supercooled droplets. At this point, the FAA considers that the environment of concern includes supercooled droplets with diameters ranging from 50 to 400 microns, and a liquid water content of 0.4 grams per cubic meter. The amount, location, and effect of this ice accretion are significantly influenced by the wing angle of attack and changes thereto. Angle of attack may be affected by changes in flap configuration.

The FAA is open to suggestions as how best to determine the susceptibility of the airplanes to an uncommanded roll condition, but the manufacturers will be encouraged to act expeditiously.

This examination or testing process is not intended to substantiate the ability of the airplane to operate in the large supercooled droplet environment. The intent is to ensure that an unsafe condition does not exist and that, if the airplane is inadvertently operated in this environment, there will be a means to identify and procedures to safely depart from the condition.

Approaches to Consider

While the means to determine susceptibility to uncommanded roll due to ice accumulation on the wing unprotected surface may vary for different airplanes, there are several approaches that the ACO and the manufacturer might consider:

- Flight tests using an icing tanker airplane will provide documented results, provided the droplet size is appropriate for the large supercooled droplet environment. Testing for the ATR-72 utilized droplet diameters and liquid water content significantly outside the Appendix C envelope. This environment is believed to have existed in the vicinity of the Roselawn accident. The FAA is exploring the availability of the Air Force Icing Tanker to investigate this phenomenon on airplanes of concern, if the manufacturers wish to pursue this method of evaluation.
- Another approach might be high-speed taxi tests, with an ice shape representative of that which might develop behind the active area of the deicing boots during a large supercooled droplet encounter, to determine if anomalous aileron forces develop. The location of the ice shape might be determined by the use of droplet trajectory codes.
- It is possible that natural icing flight tests could be performed, but that seems unlikely as a solution because of the difficulty in finding and measuring the large droplet-size environment.

FAA's Commitment to Action

The FAA is committed to taking definitive action addressing this problem before the beginning of the next icing season. If it is determined that an airplane type is susceptible, the FAA may require design changes or may issue a procedural AD for an interim procedure similar to that currently issued for the ATR-42 and ATR-72 airplanes.

If it is determined that an airplane may be susceptible to control problems when operating in large supercooled droplets and time is needed to develop design changes, interim procedures may consider the following:

a. There should be a means for the flightcrew to determine when the airplane has inadvertently entered into a large supercooled droplet environment, to enable the crew to take appropriate action.

b. A means must be developed to ensure that the airplane can be safely operated until the environment is exited.

c. There must be appropriate crew information provided that describes the limitations to be observed while exiting the large supercooled droplet environment.

d. There must be a means available to the crew to determine when the hazard no longer exists, e.g., that the ice accreted during operation in the large supercooled droplet environment has melted or sublimated from the airplane.

Continued on page 54

Aviation Weather Research Will Provide Improved Weather Information

Weather is a major impact on air transportation. Airport capacity utilization, preflight planning, takeoffs, landings, and the duration and route of the actual flight are all affected by weather conditions.

In support of aviation operations, accurate weather forecasts are not available currently to support aviation operations on a time scale comparable to that of most domestic flights, which range from 30 minutes to several hours. Current forecasts are based on 12-hour observations spaced 200 miles apart across the United States. High resolution forecasts, in regards to both location and time, are unavailable, and manual analysis to identify specific aviation weather impacts (*e.g.,* icing, turbulence) cannot provide the product timeliness and resolution required to significantly reduce weather-related delays.

On a national scale, poor forecast resolution and slow update frequency result in weather advisories that are ineffective. Also, the present system does not provide a coherent picture of the weather effects on aviation, which is needed to enhance the decision-making process by pilots and flight support services, including air traffic control facilities in the terminal, enroute, national and flight service station areas; flight dispatch, airport operations; and meteorologists.

The goal is to provide timely, accurate, reliable, and user-friendly weather information, without the intervention of a meteorologist, to traffic managers, pilots, dispatchers, and aviation system users.

Aviation Weather Research

The FAA's Aviation Weather Development Program, ARD-80, is sponsoring basic and applied research in order to improve weather information provided to the National Airspace System. This research will increase the scientific understanding of atmospheric processes that cause the development of hazardous weather that impacts aviation, such as low ceiling and visibility, icing, turbulence, and thunderstorms. This research includes two major components:

1. The development of models and algorithms necessary to generate analysis and predictions of aviation weather information; and
2. Performance of scientific tests and evaluations as necessary to validate the accuracy of the information before it is transferred to an FAA, National Weather Service (NWS), or industry system for implementation.

System prototyping, using commercial off-the-shelf computer hardware, is used to develop and evaluate capabilities for processing weather data and display of weather products. Software is developed to evaluate the most capable system and processing architecture, to establish a data and system management capability, and to display weather products. Also, system interfaces are developed to obtain data from weather sensors and other information from FAA and/or NWS sources. Finally, the system is placed in an operational environment for demonstration and validation of the proposed product, or products, that will satisfy requirements.

"Through these research efforts, we're hoping to generate weather observations, warnings, and forecasts that are more accurate and accessible," said **Warren Fellner** of the Aviation Weather Development Program.

Statistics and Graphics Contribute to Research

The effectiveness of aviation weather research efforts is enhanced by the availability of high resolution analyses, and forecasts of aviation impact variables (AIV) provided by the Aviation Gridded Forecast System (AGFS), which is being developed for the FAA and the NWS by the National Oceanic and Atmospheric Administration's Forecast System Laboratory.

Providing numerical and statistical techniques, the AGFS automatically generates a high-resolution analysis and forecast of AIV's, such as winds, temperature, icing, turbulence, cloud base height, visibility, hail, and convective precipitation. The AGFS is being incorporated into the National Weather Service's supercomputer software for generation of the variables.

Product generation and display software will convert the AGFS data into weather products in the form of graphic images of current and forecast aviation weather impact areas.

Each company was chosen for CRDA participation on the basis of its ability to produce, disseminate, and integrate real-time weather products for use in industry as well as government. According to Fellner, working for the FAA on weather product CRDA's, "The participation of the companies in the CRDA's is important: it allows technology transfer to the private sector from the work that the FAA is doing in aviation weather research."

"... it allows technology transfer to the private sector from the work that the FAA is doing in aviation weather research."

Cooperative Involvement Important for Technology Transfer

Recognizing that the private sector, particularly the weather information industry, has capabilities that could be used to further the advancement of aviation weather research, the FAA has entered into Cooperative Research and Development Agreements (CRDA) with several companies. The companies participating include:

- Kavouras in Minneapolis, Minnesota;
- WSI Corporation in Billerica, Massachusetts;
- Harris Corporation in Melbourne, Florida;
- Lockheed Corporation in Austin, Texas; and
- GTE in Chantilly, Virginia.

Under the CRDA's, the FAA will distribute algorithm and display software to each company and the companies will provide feedback on the effectiveness of the software in a number of ways, including:

- Participating in aviation weather user group workshops in the formatting and validation of aviation weather graphics requirements.
- Supporting the creation of aviation weather graphics products.
- Participating in the development of a standard aviation weather graphic product format that is compatible with a generic computer graphic workstation.
- Supporting the FAA in the development of reports that document the results of the CRDA's efforts, which will be shared with the aviation weather community.

Capabilities Developed through Research Will Enhance Air Safety

Past and current research efforts have been focused on topical meteorological phenomena that are significant aviation weather hazards, such as in-flight icing, ground deicing, ceiling and visibility, turbulence, etc. This research has achieved marked improvements in the understanding and the ability to forecast icing/deicing conditions.

Another major area being addressed is ceiling and visibility. More sophisticated numerical model prediction approaches are being investigated contributing to progress in this area. An algorithm to detect in-flight turbulence has been developed and it is expected that its implementation will result in more objective measurement of turbulent areas.

"The bottom line is air safety, " said Fellner. "By improving forecast products, you can enhance the capability to provide effective flight planning and user-preferred routing. If you are able to accurately forecast weather-impacted airspace, air travel becomes safer and more fuel efficient."

For more information on this topic, please contact:

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Pegasus Successfully Launches First Two ORBCOMM Satellites

Orbital Sciences Corporation announced on April 3, 1995, that its Pegasus air-launched rocket successfully placed the first two ORBCOMM communications satellites, along with a third MicroLab-1 scientific spacecraft, into their targeted orbits approximately 455 miles above the Earth. The launch was carried out from Vandenberg Air Force Base, California.

With the successful launch and initial testing of the first two ORBCOMM satellites, Orbital is poised to begin a global revolution in low-cost personal communications. Through a 26-satellite system planned for launch in the next two years, ORBCOMM is designed to provide affordable global messaging and position determination services. Initial intermittent services using the first two satellites launched on April 3 will be offered in the United States later this spring, with international services to closely follow.

"The launch of the first ORBCOMM satellites is both an ending and a beginning," said **David W. Thompson**, Orbital's President and Chief Executive Officer. "Culminating over four years of hard work and intense dedication from many people at Orbital, this successful launch brings ORBCOMM to the point of final implementation. At the same time, we are now ready to introduce a fundamental change in the way people all over the world live, work, and play through our low-cost satellite-based communications network that will work everywhere.

Initial indications are that Orbital's patented MicroStar satellite constellation deployment sequence worked as planned. For this mission, the first ORBCOMM satellite was released from the rocket's third stage in a southerly direction minutes after orbit was achieved. Pegasus then carried out an attitude adjustment maneuver, realigning itself to face in a northerly direction for the deployment of the second ORBCOMM satellite. Another attitude adjustment occurred in preparation for the release of the MicroLab-1 satellite. Final orbital positioning of the ORBCOMM on the opposite sides of the Earth is planned to occur over the next two months.

In addition to the ORBCOMM satellites, Pegasus also carried the Orbital-built MicroLab-1 satellite. MicroLab-1 carries two scientific research payloads: the Optical Transient Detector built by NASA's Marshall Space Flight Center, and the GPS Meteorological Experiment sponsored by the National Science Foundation. The MicroLab satellite is based on the MicroStar standard satellite bus, developed specifically for ORBCOMM. However, MicroLab is somewhat larger than the ORBCOMM/MicroStar satellite, allowing it to support heavier scientific payloads.

Pegasus was carried to its launch altitude of 40,000 feet approximately 50 miles off the California coast by the company's modified Lockheed Model L-1011 airplane, where it was released in a horizontal position and experienced a planned 5-second free fall prior to the first-stage rocket motor ignition. The three-stage rocket, which follows a lift-assisted trajectory with the use of a wing, reach orbit approximately 12 minutes later.

Pegasus was developed by Orbital and Hercules Aerospace Company with private capital. Its innovative air-launched approach pioneered a range of technological innovations in rocket design, manufacturing techniques, and launch operations, making Pegasus more reliable, flexible, and affordable. The Pegasus XL vehicle is also now available, offering enhanced performance capability. Both vehicles are launched from the company's L-1011 launch vehicle carrier aircraft, further increasing mission flexibility and rapid response capability.

Orbital is a space technology company that designs, manufactures, operates, and markets a broad range of space products and satellite-based services, including launch vehicles, spacecraft, space sensors, avionics, satellite tracking systems, and satellite-based communications, navigation , and Earth observation services. The global ORBCOMM satellite system is a joint venture of Orbital and Teleglobe, Inc., of Montreal, Canada. ✠

Cyberspace Data Monitoring System

Space flight controllers at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, may be spending most of their time in cyberspace — not to navigate the Internet as most computer users would — but to monitor real-world spacecraft exploring new vistas in space billions of miles away.

The three-dimensional software tool that will make this possible — called the *Cyberspace Data Monitoring System* — is currently under development at the Laboratory and being designed to monitor the health and status of spacecraft and Earth-orbiting satellites.

The new software boasts colorful display grids of spacecraft subsystems. Each grid can be rotated at different angles to give controllers different dimensional views of the data. If the information is being viewed at more than 100 percent on the screen, the controller can "fly over" the data grid using a mouse, and zoom in on other subsystem information. Up to 20 or 30 individual spacecraft can be monitored simultaneously with this new cyberspace feature.

"This graphical interface represents a next generation approach to monitoring systems for a variety of space flight and terrestrial applications," said **Dr. Ursula Schwuttke**, supervisor of the JPL Flight Projects Office Information Systems Testbed, which is developing the software interface.

"There are myriad advantages to displaying spacecraft subsystem information in an abstract, visual way," she said. "Most importantly, a visual software interface allows us to display a dramatically increased amount of data all at the same time and it gives operators immediate visual recognition of potential problems by using icons that change in color or begin flashing when a situation is becoming serious on board the craft."

The system is a departure from conventional text-based software programs. Rather than displaying tables of alphanumeric data and text, the cyberspace environment presents data in three dimensions, using specified colors and shapes, such as squares, circles and diamonds, to denote different data channels and values. Motion is used to denote changes in status quo.

In the 3-D environment, flight controllers can pitch, yaw, roll, zoom in and zoom out of data grids that are displaying information about the status of spacecraft subsystems such as power, temperature, alarms and star calibration reference points.

When a channel goes into alarm, its corresponding channel object or icon changes color and position. Two types of alarms are detected by the system: conventional limit-based alarms and trend alarms, which have not typically been used in monitoring systems.

Trend alarms display the rate of change of a channel value. If the rate of change exceeds a predefined magnitude over a predefined time period, then the channel triggers a trend alarm. For example, if the temperature on board the spacecraft is heating up to unusually high levels, or a gyro is beginning to drift off course, the corresponding channel objects will change colors from yellow to red. The channel objects will also spin if they are in yellow and flash if they are being displayed in red.

This scheme allows for the unambiguous display of all the various alarm combinations. At any time, regardless of whether a channel is in alarm, the user can click on a channel object using the mouse, and pop up a text window that displays all the information about the channel that was selected, including its value and alarm status.

The software provides mission analysts with short- and long-term trend analysis capabilities. Short-term trend analysis, consisting of the trend alarming system of spinning and flashing motions and color changes, occurs automatically. On-demand, long-term trend analysis will provide detection of alarm conditions that manifest themselves over extended periods of time and the ability to display plots of any telemetry channel over the same time periods.

"Trend analysis is very important since JPL's Multimission Ground Data System does not provide that capability and mission analysts currently have access to trend information only if the analysis has been performed by hand," Dr. Schwuttke said.

Continued on page 54

GPS as Primary Navigation for Oceanic and Remote Operations

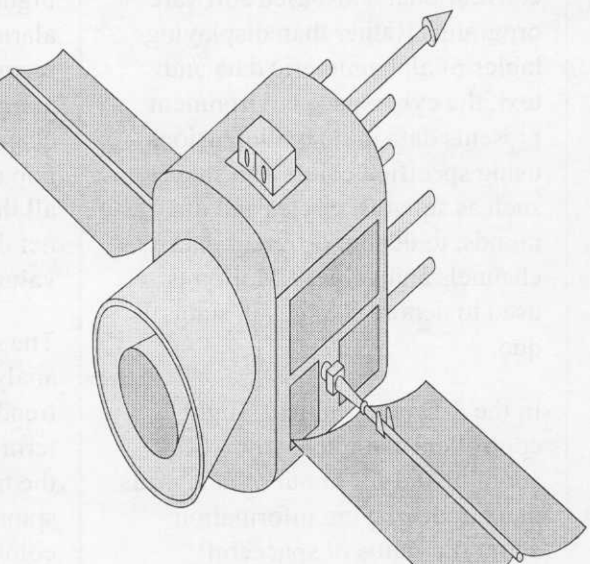
The Aircraft Certification Service issued Notice 8110.GPS, proposing interim guidance for approving the installation of Global Positioning System (GPS) equipment to be used as a primary means of navigation for oceanic/remote operations. The Notice implements guidelines that the Satellite Operational Implementation Team (SOIT) recommended and Anthony Broderick, FAA's Associate Administrator for Regulation and Certification, approved in a memo and position paper dated December 5, 1994.

To avoid redundancy, the availability requirement outlined in the position paper does not appear in the draft Notice. The requirements of Technical Standard Order (TSO) C-129 assure adequate availability. A copy of the position paper can be obtained from B. DeCleene, (202) 267-8049.

As a reminder, the Approval Process from that document is repeated here:

a. The GPS equipment manufacturer or aircraft manufacturer obtains a TSO-C129 authorization (Class A1, A2, B1, B2, C1, or C2) from the cognizant ACO. Alternatively, the applicant must demonstrate that performance requirements of TSO-C129 are met.

b. The applicant obtains installation approval of the GPS navigation system via the TC or STC process. The equipment must be installed in accordance with Advisory Circular (AC) 20-138 *(Airworthiness Approval of GPS Navigation Equipment for Use as a VFR and IFR Supplemental Navigation System)*, or AC 20-130A *(Airworthiness Approval of Navigation Sensors)*.



The FAA Form 337 process may be used for follow-on installations of the same navigation system for which there is a type certificate (TC) or supplemental type certificate (STC) in the same model aircraft and the engineering data developed for the initial certification is used to accomplish the follow-on installation approval. Appropriate operational procedures assumed for aircraft certification must be identified in the aircraft flight manual supplement.

c. The applicant applies to the appropriate Flight Standards District Office (FSDO) for operational authorization to use the GPS system(s) or GPS-based multi-sensor navigation system for the intended operation (e.g., use of GPS in lieu of Omega or Inertial Navigation System for Class II navigation, or use of GPS/FMS for a particular oceanic/remote route.

d. In accordance with appropriate FAA handbook orders and bulletins (e.g., FSAT 94-XX), the Principal Operations Inspector (POI) will review the applicant's airworthiness approval, navigation procedures, training, maintenance, procedures for use of the FDE prediction program, and other operational issues related to GPS. Following an acceptable review, the POI may issue appropriate operations specifications or a FSDO letter of authorization for the intended operations.

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General News

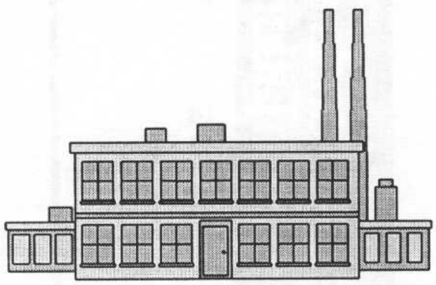
Contamination of Hydraulic Production Systems

Many production facilities use hydraulically-powered machines for processes such as machining, stamping, and molding.

Recent studies have shown that 50-75% of all hydraulic system failures are a direct result of contamination of the hydraulic fluid.

This contamination results in degradation and jamming of components, causing product defects.

Contamination is frequently missed as the root cause of product defects because in some cases the particuates responsible become dis-lodged and are brushed away.



The susceptibility of a hydraulic machine to contamination is a product of several factors:

- The sensitivity of the internal components to contamination.
- The ability of the hydraulic fluid to protect the system from various types of wear.
- The operating environment.
- The severity of the application.

Source: "For Quality's Sake, Maintain Hydraulic Machines," by Drew D. Troyer and Lisa K. Lazzeroni, Quality Progress, *October 1994*

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General News

Statistical Process Control (SPC)

The display of innumerable control charts on a factory wall is not necessarily evidence in itself of proper and aggressive implementation of both SPC and continuous improvement.

Control charts should be used primarily as a tool for problem solving, not process monitoring. Once proper and adequate controls are developed for a process, it should be periodically audited, and the control charts removed. Thus, only control charts for processes requiring control should be more visible.

SPC for Short Production Runs

The control charts usually applied to manufacturing are most feasible when applied to long production runs. For short production runs, sufficient data can not be collected to establish the control limits for the process, or otherwise produce only a few new points on the control charts that are insufficient to detect trends in the process.

One method of applying SPC to short production runs is the *difference control chart*. There are several variations of this chart, but each plots deviations from some reference rather than plotting the measured values directly. These charts are known by names such as *Grubbs' Difference Chart, Adaptive Control Charts, and Delta Control Chart.*

Sources: "The Use of Delta Charts in Short Run Statistical Process Control," by Victor E. Sower, Jaideep G. Motwani, and Michael J. Savoie, 1991 ASQC Quality Congress Transactions.

Shewhart Charts & Pre-Control: Rivals or Teammates?" by Tripp Martin, ASQC Statistics Division Newsletter, Spring 1993.

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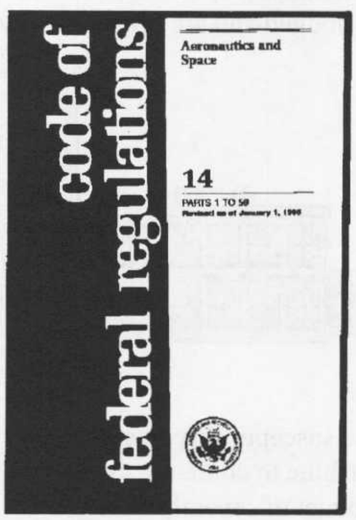
FAA Policy Concerning Use of Dynamically Tested Seats in New or Modified Transports

Part 25 of the Federal Aviation Regulations (FAR) was amended by Amendment 25-64 in 1988 to include a new Section 25.562 entitled *"Emergency landing dynamic conditions."* This section requires the passenger and crew seats in transport category airplanes to be designed and shown by tests to protect each occupant during an emergency landing.

Compliance entails testing of such seats under dynamic conditions using anthropomorphic test dummies. In addition to showing the structural integrity of the seats and seat attachment structure, the tests must show that seat occupants would not be subjected to more than specified upper torso, pelvis, and lumbar loads. The tests also must show that occupants would not be subjected to more than a specified Head Injury Criterion (HIC).

The following guidance is prompted by numerous questions received from the field and from industry regarding compliance with section 25.562. In addition, many items were raised at an industry meeting held in Seattle on February 28 and March 1, 1995.

The following guidance, and the questions that prompted it, are provided for your information and may be used immediately. Where this guidance may conflict with procedures used in the past, there is no intent to invalidate any previous approvals.



The part 572 Anthropomorphic Test Device (ATD) does not weigh 170 pounds, as specified in the regulation. Should the ATD be ballasted?

The regulation contains a built-in conflict in that both the ATD specification and its weight are mandated. Since the specification already includes weight information, specifying both variables at the same time can result in non-standardization. The potential for non-standardization is considered greater if the ATD is ballasted. Therefore, the specified ATD should be used, but should not be ballasted [other than the clothing and shoes called for in SAE Aerospace Standard 8049 and Advisory Circular (AC) 25.562-1].

Must all items attached to the seat remain attached during testing?

In general, items of mass should remain attached to the seat during testing. This is necessary, as a minimum, to demonstrate that the seat structure is capable of carrying the load for its entire mass. In addition, items of mass of any significance could become both an evacuation hazard, as well as dangerous projectiles. Nonetheless, detachment of certain items, such as an in-arm ashtray or decorative trim, can be considered inconsequential and should not be grounds for re-test (the means of restraint should be improved, however). In any case, the separation of an item of mass should not have any sharp or injurious edges. Function of equipment or systems after the test is not required. Once an item of mass has been demonstrated to be retained in its critical loading case, subsequent tests may be conducted with the item secured for test purposes.

What is the desirable seat belt preload?

After initially specifying an amount of seat belt adjustment force, the FAA has determined that this is not a practical method of achieving the objective of the test. First, there was confusion as to whether this meant residual tension in the belt (no), or the amount of force used to tighten the belt (yes). The objective is that the belt be snug about the ATD. Normally, this can be met when two fingers will fit snugly between the seat belt and the pelvis of the ATD.

Does substitution of dress covers require a re-test?

Typical dress cover fabrics, including leather, can be substituted for each other without a re-test. The change in friction due to dress cover alone is considered less significant than the variations possible due to clothing, etc. Dress covers that exhibit very low friction coefficients (i.e., hard plastics, which are not in use, to our knowledge) may require some re-substantiation.

What is acceptable accelerometer placement?

Accelerometer placement can influence measurement of the test deceleration pulse. The accelerometer should be located so that there is no ringing or attenuation in the output. This usually requires mounting on or very close to the test sled. Ideally, the accelerometer should be mounted on the floor or base plate of the test sled. This will minimize variability in test results due to differing rigidity of test fixtures.

Is it acceptable to use 500 frame-per-second cameras for photometric analysis, in lieu of the 1000 frame-per-second speed specified in the Advisory Circular (AC) and Technical Standard Order (TSO) C127?

Yes, both the AC and the TSO are being changed to reflect this.

Does head impact on the floor require a Head Injury Criterion (HIC) calculation?

No, due to limits in the test method, head impacts on the floor are not considered.

Are deployments of seat features such as foot rests, tray tables and armrest caps considered "permanent deformations?"

Deployable items can affect egress, and could be characterized by either the quantitative deformation limits discussed in AC 25.562-1, or qualitatively, irrespective of the quantitative displacement. Because of the number of different items involved, and the possible different interpretations for each, this item will require more study.

What is the proper time interval to calculate HIC?

The HIC is calculated during the time that the head is in contact with airplane interior features. The interval should not be artificially limited by software. This is different in the automotive standards where HIC is calculated regardless of any head impact, and so the interval is limited to avoid excessively long intervals for calculation.

Are structural failures that occur as a result of restoring the seat from the floor warpage condition (in order to take post-test deformation measurements) considered a test failure?

Such failures are not considered test failures, provided that it can be determined that they occurred during the removal of floor warpage, and not during the test. Note that the measurement of permanent deformation in the seat may be determined either before or after applying floor warpage, but should be consistent pre-test or post-test.

Is a floor required for the ATD's feet during the 16 g <u>structural</u> test?

A floor is not required for this test, but if it is used, it should not influence the seat performance, or unduly restrict movement of the ATD's feet, particularly when floor warpage is applied.

What effect does a change in seat belt color have? What effect does a change in seat belt length have?

It is true that certain dyes can affect seat belt strength. The simplest approach is to test with the lowest strength color of a given belt, and thereby qualify all other colors by similarity. This issue is not fully resolved, however, and further guidance will be forthcoming.

How much damage is allowable for seat belts?

Since the dynamic tests are ultimate load tests, a certain amount of belt damage can be expected. This can include scuffing, stretching and minor fraying of fibers. However, the belt webbing should not be cut or torn by features of the seat or belt buckle adjuster assembly. Such cuts or tears can result in unpredictable performance, and generally indicate a non-compliance with the provisions of TSO C22. A decision on whether a re-test is necessary will have to made on a case-by-case basis after corrective action is identified. Cuts to the belt that occur as a result of interaction with the ATD due to bearing on irregular surfaces would not be considered failures, if all of the other pass/fail criteria are demonstrated.

Occasionally, upper torso webbing becomes trapped between the ATD's arm and shoulder, or the lap belt becomes trapped between the pelvis and leg. Can these areas be closed off to prevent such occurrence?

The discontinuous area at the ATD's shoulder/arm joint is an area of relatively lower biofidelity. A upper torso restraint that ends up in this area is considered acceptable as having "remained on the ATD's shoulder." Provided that the lap-belt is still over the ATD's pelvis, trapping of the webbing between the leg and the pelvis is acceptable. For belt angles between 45 and 55 degrees, submarining has not been a problem, so trapping of the belt in this area is not necessarily an indication of submarining. In this regard, a separate camera to evaluate submarining is not necessary. In general, the ATD should not be modified, except as described in AS 8049 and AC 25.562-1.

Other issues on this subject that currently are being studied for possible incorporation in to a revised AC 25.562-1 include:

- distortion of the critical legs for multi-leg seat assemblies,
- occupancy of front rows for HIC testing, replacement of restraint systems, and
- determination of "*critical case*."

We will provide additional data as soon as it is available.

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Policy and Guidance

Interpretation of FAR 21.99

The following is a policy interpretation that has been provided by the FAA's Aircraft Engineering Division and coordinated with the legal counsel in FAA's Washington Headquarters and Northwest Mountain Region.

In response to request for a regulatory interpretation of Federal Aviation Regulations (FAR) section 21.99(a)(1) and (a)(2), "*Required design changes,*" we present the following information:

QUESTION: Could a set of instructions be used in lieu of a design change to satisfy the intent of section 21.99(a)(1)?

RESPONSE: Section 21.99(a) requires the holder of a type certificate (TC) to submit appropriate design changes for approval when the Administrator finds that a design change is necessary to correct the unsafe condition addressed by an airworthiness directive (AD). However, there is no indication in the regulation that this obligation is limited to those situations where a design change is the only means of addressing the unsafe condition. In situations where a design change would correct the unsafe condition, but other, possibly less burdensome, actions would be equally effective the TC holder can properly be requested to submit either a design change or an alternative. Failure to submit one or the other within a reasonable time would constitute a violation of section 21.99(a) that may serve as the basis for legal enforcement action.

QUESTION: Is the intent of section 21.99(a)(2) to make available the descriptive data covering the changes to all operators satisfied by providing the data to the manufacturer's authorized service center?

RESPONSE: We assume that the manufacturer would identify the authorized service center in response to each request for the descriptive data. If the authorized service center complies with section 21.99(a)(2) by providing the data to each requesting operator, the TC holder would be considered to be in compliance.

However, the TC holder would not be considered in compliance with section 21.99(a)(2) if the authorized service center did not make such data available to each requesting operator. As a matter of practice, a review of the arrangement between the TC holder and the service center would reveal whether the service center is obligated (to the TC holder) to disseminate the descriptive data to operators requesting it.

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Enhanced Enforcement of Replacement and Modification Parts

The Aircraft Certification Service published a Notice of Proposed Rulemaking in the **Federal Register** on February 24, 1995, to notify the public that it intends to enforce full compliance with certain regulations on producing modification or replacement parts for sale for installation on type certificated products. Comments were due by May 30, 1995.

Background

In the past few years, there has been increased awareness of, and concern about, the use of unapproved parts on aircraft. It is not acceptable for persons to produce parts without compliance with Federal Aviation Regulations (FAR) section 21.303(a), "*Replacement and modification parts.*" It is the FAA's intention to ensure that all persons who produce parts for sale for installation on type certificated products comply with the regulations.

The FAA recognizes that some producers may have relied on previous FAA statements and practices regarding enforcement of the rule. Therefore, the FAA published the Notice to ensure industry-wide awareness of the agency's intent to enforce these regulations.

Part 21 Regulations

Section 21.303(a) provides that no person may produce a modification or replacement part for sale for installation on a type certificated product unless it is produced pursuant to a parts manufacturer approval (PMA).

Section 21.303(b) provides exceptions to this requirement, including parts produced by an owner or operator for maintaining his/her own product, parts produced under an FAA technical standard order (TSO), and standard parts (such as bolts and nuts) conforming to established industry or U.S. specifications.

It is the FAA's intention to ensure that all persons who produce parts for sale for installation on type certificated products comply with the regulations.

The Parts Approval Holder

A person who holds a PMA, TSO authorization, or production certificate (PC), or who holds a type certificate (TC) and produces under that TC, is referred to as a *"production approval holder (PAH)."*

Under the regulations, a PAH may engage other another company (commonly called *"a supplier")* to manufacture all or a portion of the part. In the case of fabrication of complete parts, the PAH must implement procedures to ensure that the parts are fabricated and inspected using the PAH's FAA-approved quality control system.

The completed parts fabricated for the PAH by the supplier are produced "*under*" the PAH's approval. The PAH may authorize the supplier to ship parts directly from the supplier to the customer. This is commonly referred to as "*direct ship*" or "*drop ship*" authority.

In some cases, such suppliers have been producing additional parts without the direction of the PAH, and selling them directly to others in the aviation industry. In such cases, because the PAH has not exercised the required control over the fabrication of the parts, the parts are not produced *"under"* the production approval.

There appears to be a widespread misconception that any production of a part by a supplier (of that part) to a PAH is not a violation of section 21.303(a). Historically, the FAA did not vigorously enforce compliance with section 21.303(a) in these circumstances.

Thus, the FAA has been attempting to promote full industry compliance with the rules, but has so far met with only limited success.

Unfortunately, there has been insufficient response from the suppliers, and there continues to be suppliers producing replacement and modification parts for sale for installation on type certificated products without a PMA and without direct or drop ship authority from a PAH.

Inaction by the FAA as well as statements made by agency officials may have contributed to this fact.

Shortly after Phase I was issued in October 1992, the then-Director of the Aircraft Certification Service, anticipating a significant transition period in approving parts produced by suppliers, advised FAA field office to refrain from directing such suppliers to cease shipment of such parts, and to encourage them to apply for PMAs.

This direction was widely circulated within the industry.

Further, there are other persons (not suppliers to a PAH) who may be producing parts for sale for installation on type certificated products and who also do not hold a PMA.

The overall purpose of this new policy is to make clear that the FAA will undertake enhanced enforcement of section 21.303(a).

Parts Approval Action Team

By Notice 8110.44, dated September 25, 1992, the FAA chartered the *Parts Approval Action Team (PAAT)* to develop policies and procedures to facilitate approval of PMA application by suppliers to PAHs.

Under **PAAT Phase I**, the FAA issued Notice 8110.45, dated September 25, 1992. That notice provided simplified procedures for the issuance of PMAs to suppliers who showed evidence of a licensing agreement with a PAH.

Under **Phase II**, the FAA issued Notice 8110.51, dated May 13, 1994. That notice provided procedures for the issuance of PMAs to suppliers who could show that their product design was identical to that of a part produced under a TC.

The intent of Phases I and II was to ensure compliance with section 21.303(a) by suppliers who were shipping directly to customers outside of the PAH's approval, but who could demonstrate that they were producing a part whose design and quality control already had been approved by the FAA.

"New Policy"

The overall purpose of this new policy is to make clear that the FAA will undertake enhanced enforcement of section 21.303(a).

This policy made provisions for a 90-day period during which persons were permitted to begin application for a PMA without the information in the application being used to initiate enforcement.

During this period (which ended May 30, 1995) and immediately thereafter, the agency devoted the bulk of available FAA resources to ensuring compliance through processing the anticipated new applications. Accordingly, enforcement for this brief period may be constrained by the availability of resources, and will be focused on immediate safety concerns. Thereafter, the agency will be free to effect a balanced enforcement posture across the board.

Who the Policy Applies To

Note that this policy applies only to persons who produce parts. It does not affect the responsibility of persons who maintain aircraft.

Under FAR section 43.13(b), *"Performance rules, general,"* each person maintaining or altering, or performing preventive maintenance shall do that work in such a manner and use materials of such a quality that the condition of the aircraft, airframe, aircraft engine, propeller, or appliance worked on will be at least equal to its original or properly altered condition with regard to qualities affecting airworthiness.

Persons installing parts on aircraft continue to be responsible for ensuring that the product will meet the appropriate airworthiness standards.

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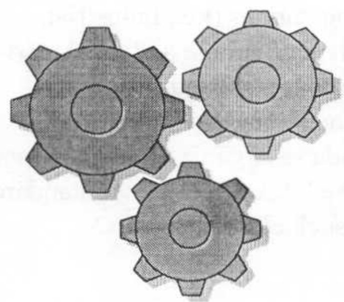
Standard and Commercial Parts Definitions

The Parts Manufacture Approval (PMA) enforcement policy described in the preceding article was published in the **Federal Register** on February 27, 1995. It has generated considerable interest by companies involved in manufacturing fasteners, bearing, electrical components, etc. They have made a strong case for special handling of these parts because of their largely standard/commercial nature.

The FAA had asked the Aviation Rulemaking Advisory Committee (ARAC) Parts Working Group to recommend new definitions for standard and commercial parts. While the FAA uses these definitions for interim guidance the ARAC parts working group will be developing guidance on the use of third party accreditation of production systems for producers of standard and commercial parts.

This article provides interim definitions for *standard parts* and *commercial parts*, interim guidance on how to apply these definitions, and interim procedures for FAA personnel. It also discusses the approval of parts under an expanded Technical Standard Order Approval (TSOA) system. These interim procedures are based on an applicant's proposed category for its parts and FAA concurrence.

These procedures will allow applicants that meet these definitions to continue producing and shipping parts until such time as final compliance or close-out instructions are available.



Standard Parts

Definition: A part manufactured in conformance with a specification established, published, and maintained by a consensus standards organization, a government agency, or a holder of an FAA Type Certificate (TC). The specification includes design, manufacturing, test and acceptance criteria, and identification requirements.

The definition of *standard part* is an expansion of the existing interpretation of Federal Aviation Regulations (FAR) section 21.303(b)(4), *"Replacement and modification parts."* The new definition recognizes specifications produced by international bodies and FAA TC holders. While not all details have been put into place regarding the administration of TC holder standard parts, we can provide the following clarifying information:

Virtually all the TC holders have standard design manuals which list hardware that they use across their product line. Not all TC holders will want to take advantage of this new provision. If a TC holder desires to do so their specifications should include all the information required under the above definition of standard part and additionally have procurement information, in some cases listing approved sources for those items.

As an example, the Boeing Company has informally declared intent to use this system. They publish a document called *"Boeing D-590 Part Standards,"* which is made available to any party on request (they may charge a fee). The document contains design specifications for over 80,000 individual part numbers. Over half of these part numbers were used on previous designs but have been superseded. One quarter of these parts are MS, AN, AS, NAS, etc., standard parts. The remainder are Boeing standard parts and are identified with a "BAC" prefix on the part number. It is intended that the BAC part marking be accepted in the same way that AN, NAS, etc., are accepted now.

Commercial Parts

Definition: Detail parts or subcomponents included in the type design or other approved design:

1. The part is generally available for applications other than aeronautical products and is not

uniquely designed for use in aircraft applications.

2. Failure of the part does not affect the continued safe flight and landing of the product.

3. Manufactured to a specification or catalog description and marked only under the identification scheme of that manufacturer.

4. Subjected to no specifically identified quality control methods beyond the principal manufacturer's own quality control system.

5. Specified in a type design or other approved design data by the design approval holder.

This definition of *commercial part* will require rulemaking in order to be adopted. Our initial feeling is that because of items 1 and 2, above, it will have narrow application, applying perhaps to electronic components (at the piece level) and non-flight related hardware.

Technical Standard Order Approval

While we have expanded the group of parts that do not require FAA approval, there remains a large group of parts for which PMA would be required.

One such group is aviation fasteners which would not qualify as commercial parts because of the non-aviation usage requirement, and also would not qualify as standard parts because they are generally produced to a proprietary specification. Attaining PMA on such parts can be problematical because they used on multiple products and perhaps multiple applications on the same product.

Based on the above, a logical avenue for approval of these types of parts is TSOA. Currently, individual members of the ARAC Parts Working Group are soliciting their industry representative organizations (i.e., Industrial Fastener Institute and the American Bearing Manufacturers Association) to act as consensus standards organizations to propose to the FAA performance standards for such classes of parts.

Parts Category Decision Tree

The decision tree incorporating the definitions above appears on the following page. It is meant to provide a structured method by which an applicant and the FAA may make a determination of the approval means (or non-approval in the case of standard and commercial parts) most appropriate for the part.

Procedures

1. FAA offices should send a copy of these definitions and the attached flow chart to all respondents to the Federal Register Notice asking them to, within 30 days, do the following:

   a. The applicants should evaluate their parts against these new definitions using the Parts Category Decision Tree and inform the FAA which parts (by part number) would be classified as standard, commercial, or could be approved under a TSO.

   b. If the applicant is stating that their parts could be produced under a TSO then that applicant should submit the name of the consensus setting organization and a contact point that will be proposing the new TSO.

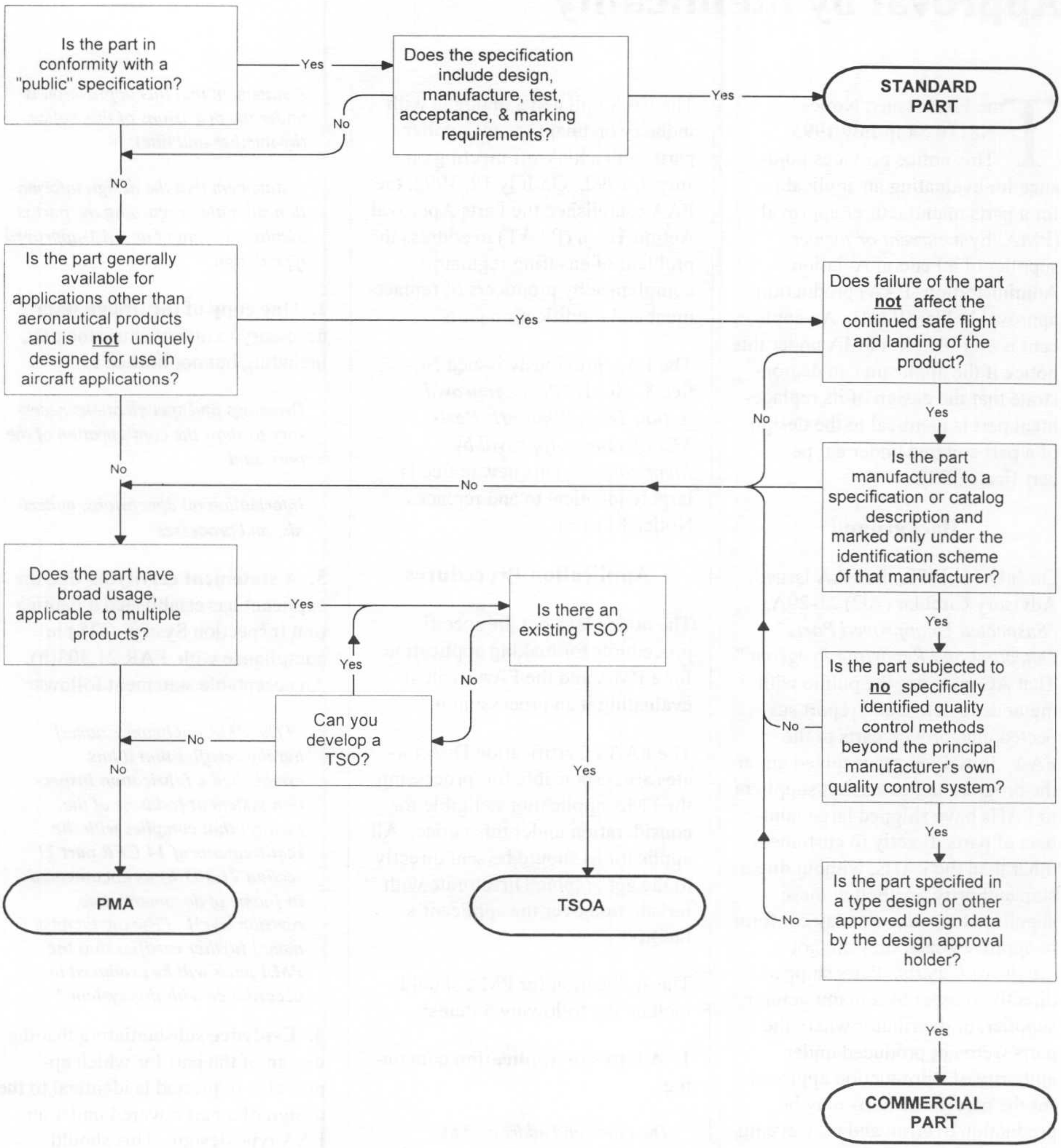
2. FAA offices should respond to the applicants in the following manner:

   a. *For Standard Parts or Commercial Parts:* The FAA should write a letter back to the applicant authorizing them to continue production and shipping of the listed parts, and informing them that further compliance instructions or a close-out notification on their application for those parts will be forwarded once these procedures are finalized.

   b. *For parts which could be approved under a new TSO*: The FAA should write a letter back to the applicant authorizing them to continue production and shipping of the listed parts and informing them that further compliance instructions for those parts will be forwarded once these procedures are finalized or if any further action is required.

   Any inquiries regarding the establishment of a new TSO should be forwarded to the FAA Egineering Division, AIR-120, at FAA Headquarters in Washington, DC.

Parts Category Decision Tree



FAA Notice N8110.54, "Parts Manufacture Approval by Identicality"

The FAA issued Notice N8110.54 in July 1995. This notice provides guidance for evaluating an application for a parts manufacturer approval (PMA) by a *current or former* supplier of a Federal Aviation Administration (FAA) production approval holder (PAH). An applicant is eligible for a PMA under this notice if the applicant can demonstrate that the design of its replacement part is identical to the design of a part covered under a type certificate (TC).

Background

On July 16, 1992, the FAA issued Advisory Circular (AC) 21-29A, *"Suspected Unapproved Parts Detecting and Reporting Program."* That AC provides the public with methods to detect and report suspected unapproved parts to the FAA. Initial reports received under the program indicated that suppliers to PAHs have shipped large numbers of parts directly to customers other than the PAHs, without direct ship authority. Although these supplier-shipped parts may conform to approved data, they are not *"approved"* parts. Parts shipped directly to users by a manufacturer, supplier, or distributor where the parts were not produced under authority of a production approval for the part (these parts may be production overrun and may eventually be found to be acceptable).

The FAA initiated a dialogue with industry on unapproved supplier parts with a kick-off meeting on July 9, 1992. On July 12, 1992, the FAA established the Parts Approval Action Team (PAAT) to address the problem of ensuring regulatory compliance by producers of replacement and modification parts.

The FAA previously issued Notice 8110.51, *"Parts Approval Action Team, Phase II: Parts Manufacturer Approval by Identicality."* This new notice is largely identical to and replaces Notice 8110.51.

Application Procedures

The notice lays out the specific procedures for making application for a PMA and the FAA's role in evaluating it an processing it.

The FAA's Certification Directorates are responsible for, processing the PMA applications eligible for consideration under this notice. All applications should be sent directly to the geographic Directorate with jurisdiction over the applicant's facility.

The application for PMA should include the following 9 items:

1. A letter of application containing:

> *The name and address of the manufacturing facilities where the part is to be manufactured;*
>
> *A statement that this application is under the provisions of this notice, (by number and title);*
>
> *A statement that the design information submitted regarding the part is identical to that of an FAA-approved type design.*

2. One copy of the design data necessary to manufacture the part, including but not limited to:

> *Drawings and specifications necessary to show the configuration of the part; and*
>
> *Information on dimensions, materials, and processes.*

3. A statement certifying that the applicant has established a Fabrication Inspection System (FIS) in compliance with FAR 21.303(h). An acceptable statement follows:

> *"[The PMA applicant's name]* ***hereby certifies that it has established a fabrication inspection system at*** *[address of the facility]* ***that complies with the requirements of 14 CFR part 21 section 21.303(h) as documented in*** *[name of document, date, revision level]. [The applicant's name]* ***further certifies that the PMA parts will be produced in accordance with this system."***

4. Evidence substantiating that the design of the part for which approval is requested is identical to the design of a part covered under an FAA type design. This should include evidence that the applicant *currently is or formerly was* an approved supplier, to an FAA PAH, of the part for which the application has been made. (Examples would include a purchase order for production delivery from the PAH and/or a copy of the PAH's most recent quality assurance audit report, if one is available, regarding the applicant as a supplier.) The applicant should submit documentation on whether the applicant has an existing quality assurance system under the existing production relationship with the PAH and has responsibility for final design conformity inspection.

5. The applicant must submit data substantiating that he has provided for any substantive processes, inspections, or tests performed by the PAH under their supplier relationship, such that the applicant has established the same level of assurance of design conformity under the PMA. If no such processes, inspections, or tests are performed by the PAH, the applicant must so state.

6. Determination that there are no airworthiness directives or unresolved service difficulties involving the part.

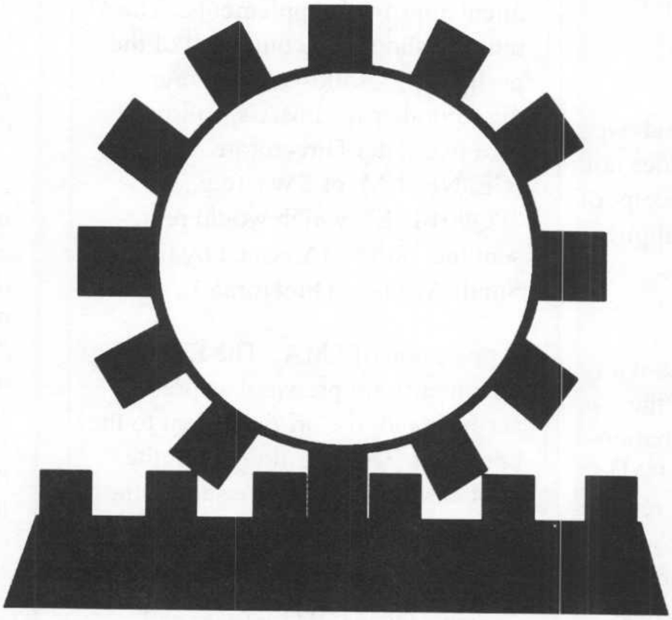
7. All evidence that would help in substantiating that the part is eligible for installation on the type certificated products identified in the application. (Examples include purchase orders from the PAH, maintenance manuals, technical publications index, service bulletins, and/or illustrated parts catalog.) The evidence submitted must be valid, and obtained from a recognized document source.

8. A PMA supplement prepared in accordance with the sample provided in Appendix 4 of this notice (applicants are encouraged to submit supplements in a compatible electronic format). The appendices of the Notice provide detailed instructions in preparing and formatting the supplement. In general, however, the body of the supplement should include the following information:

Part Nomenclature and Part No. The PMA part name and number.

Approved Replacement For. Provide the PAH's name and part number.

FAA Approval Basis and Approved Design Data. State the approval basis (i.e., identicality) and reference the approved data by



drawing number, revision level, and date.

Installation Eligibility. Identify the type certificated product by manufacturer's name, model, series, and, if appropriate, serial numbers.

9. The submitted data must be specific to the part for which PMA is requested.

Disposition of Applications

Examination of Application. The processing person will verify that the application is complete by checking that all the items required (as listed above) are enclosed and prepared in accordance with the appendices of this notice.

Incomplete Applications. If the application is incomplete or not prepared in accordance with the instructions of this notice, the application package will be returned to the applicant, asking that the package be resubmitted in accordance with the instructions. Specific information on where the application was in error or omission will be provided.

Evaluation of Substantiating Data. If the application is complete, the processing person will do the following:

1. If the applicant has not stated in writing that it does not object to the FAA making publicly available the fact that the applicant has applied for PMA or the information submitted as part of the application, a certified letter will be sent to the applicant, asking the applicant whether it objects to the FAA making that information publicly available.

2. If the applicant states in writing that it does not object to the FAA making publicly available the information, a certified letter will be sent to the PAH listed in the application requesting the PAH to verify the following information submitted by the applicant:

- The applicant ***currently is or formerly was*** *an approved supplier to the PAH of the part for which application has been made;*

- No substantive processes, inspections, or tests are necessary to establish design conformity once the part leaves the applicant's quality control system; or what processes, inspections, or tests are performed by the PAH and whether or not the applicant has correctly identified such activities in the application or has proposed procedures to provide the same level of inspection to assure design conformity;

- There are no airworthiness directives or unresolved service difficulties involving the part; and

- The parts are eligible for installation on the product(s) specified by the applicant.

3. If the PAH verifies the above information, or if the PAH does not respond within **45** days of receipt of the letter, processing of the application will continue.

4. If the PAH non-concurs with the information provided by the applicant and if, after examination of the data submitted by the PAH, the processing office cannot resolve a material conflict between the applicants statements and the PAH's response, the application package should be returned to the applicant instructing the applicant to apply for PMA at the geographic ACO under normal PMA procedures.

5. If the applicant responds in writing that it objects to the FAA making publicly available the information, the application will be processed under normal PMA procedures.

PMA Issuance

A PMA may be issued after the processing person finds that the requirements listed in this notice have been met and that the applicant has established an FIS in compliance with FAR 21.303(h) and is able to determine that each part completed under the approval conforms to the design data and is safe for installation on the product(s) for which it would be eligible.

PMA Number. A PMA number, if not previously assigned to the applicant, will be assigned to all original PMA letters. The number will be unique to each PMA holder and will be carried forth on subsequent approved supplements. The number should be composed of the prefix "PQ", followed by a four digit number for PMA's, followed by a two letter Directorate identifier (CE, NE, NM, or SW), (e.g., "PQ0018CE", which would represent the 18th PMA issued by the Small Airplane Directorate).

Preparation of PMA. The following documents are prepared as prescribed, and the originals sent to the applicant. Copies, along with the application package, are sent to the geographic MIDO.

- If not already provided by the applicant, the PMA number and supplement number should be typed on each page of the applicant's supplement. A signature block should be typed on the last page of the supplement and signed by the approving official.

- An FAA-PMA letter signed by the Manufacturing Inspection Office manager or MIDO manager.

- The design data should be stamped "FAA approved" and returned to the applicant.

Identification of PMA Parts

The new PMA holder shall be informed in the PMA letter of the part marking requirements of FAR 45.15, *"Replacement and modification parts,"* and FAR 45.14, *"Identification of critical components."* For the part number, a PMA holder may use one of the following:

- The PMA holder may use the same part number as the production approval holder, provided the PMA holder also meets the requirements of FAR 45.15(a)(1) and (2) to permanently mark the part (in the same area as the part number) with the letters ***"FAA-PMA"*** *and the name, trademark, or symbol of the PMA holder; or*

- The PMA holder's part should be numbered such that it is sufficiently different from the production approval holder's part number to be distinguishable. The production approval holder's part number with a prefix/suffix is sufficient for this purpose. This prefix/suffix can also satisfy the requirements of FAR 45.15(a)(2) if the prefix/suffix is consistent across the PMA holder's product line.

The Aircraft Certification Service, Aircraft Engineering Division is responsible for this notice. Any questions or suggestions concerning the notice should be directed to the Certification Procedures Branch, AIR-110, at telephone (202) 267-9588, or FAX (202) 267-5340.

Airplane Flight Manual (AFM) Procedures for Fuel System Issues

The purpose of this article is to clarify two issues concerning the AFM procedures for fuel system conditions that may require flightcrew action.

The first issue was recognized as a result of a recent situation involving a Boeing Model 747-400 airplane. An incident occurred when a fuel leak from a crack in a fuel line located upstream of the fuel flowmeter caused the loss of 30,000 pounds of fuel. Sufficient fuel continued to be supplied to the fuel control/metering unit for normal engine operation. The flightcrew was notified of the unsafe condition via an Engine Indication and Crew Alerting System (EICAS) message that referred them to the Flight Management Computer (FMC). The FMC compares the remaining fuel quantity provided by the fuel gaging system to a calculated fuel quantity that is generated by using the initial fuel load and subtracting the fuel used by the engines. (This function on many airplanes is carried out manually by use of the fuel log.) The flightcrew, however, did not understand that this message provided indication of a possible fuel leak and, therefore, did not attempt to isolate the fuel leak.

Review of typical AFM's shows that procedures for low fuel and fuel imbalances are provided; however, no procedures are provided for identification and isolation of a fuel leak.

Similar conditions as that described above have occurred on Boeing Model 757 and Airbus Model A300-600 airplanes. Review of recent service history shows that newer technology engines incorporate design features that may contribute to increased occurrences of undetected fuel leakage within the engine compartment. Fuel leaks within earlier technology engines typically resulted in a fire and subsequent shutdown of the engine. However, many newer technology airplanes have features, such as fan case-mounted accessories and improved drainage, so that a fire frequently does not occur following a fuel leak in the fuel feed system upstream of the fuel flow meter. Therefore, cross-check of the fuel gaging system total fuel to the calculated fuel remaining, and correct crew action to identify and isolate the fuel leak, is the only means of avoiding loss of available fuel needed to complete the flight.

The second item necessitating clarification relates to AFM procedures for impending engine fuel filter bypass indications. During a recent certification project, the issue of cockpit annunciation and associated flightcrew procedures for a condition of impending engine fuel filter bypass was reviewed. Numerous recent incident reports indicating fuel contamination from causes such as microbial growth mats that form in the airplane fuel tanks, fuel tank cleaning debris, powdered fuel tank treatment chemicals, iron oxide, and water, highlight the need for consideration of fuel contamination. These incidents occurred over a broad spectrum of the transport fleet including: British Aerospace Model BAe 146 airplanes; Airbus Model A310 and A300 series airplanes; McDonnell Douglas Model DC-10 series airplanes; Boeing Model 727 and 747 series airplanes; and Canadair Challengers. Each one of these incidents occurred on airplanes with fuel filter bypass indication, and, in all but one case, the incident resulted in landing at the nearest suitable airport or a diversion, due to the indications and/or multiple engine power losses. Post-incident investigations revealed severely contaminated fuel systems in all of these cases.

Review of the airplane flight and operations manuals shows that inconsistencies exist in the information provided to the flightcrew for impending engine fuel filter bypass. These differences are the result of each manufacturer implementing its preferred systems and procedures to satisfy common FAA requirements.

However, in nearly all cases, the procedures for a ***single*** engine impending bypass indication are in concert with current FAA policy. For older technology airplanes that do not have automatic fuel heating systems, manual activation of the fuel heating system is required, and continuation to the planned destination is allowed. (It should be noted that the McDonnell Douglas Model MD-80 operations manual states that, if the fuel filter illuminates with the fuel temperature above 15 degrees centigrade, then the indication may be due to clogging by solid contaminants other than ice.) For newer technology airplanes equipped with continuous fuel heat (e.g., McDonnell Douglas Models MD-11 and MD-90, and Airbus Model A320), indication is provided for crew awareness and possible future action, and continuation to the planned destination is at the discretion of the flightcrew.

Service data show that flightcrew action following an impending bypass is greatly influenced by the type of airplane being operated and the routes being flown. For example, non-Extended Range Twin-Engine Operations (ETOPS) Boeing Model 767 airplanes have experienced 31 post-push back impending fuel filter bypass indication events that have resulted in 2 rejected takeoffs (RTO), 18 flight continuations, 5 turn back/diversions, and 6 unknown. ETOPS Boeing Model 767's have experienced 5 events resulting in 4 diversion/turnbacks and 1 continuation. The Boeing Model 757 is reported as having one in-flight case, which resulted in an engine flameout and subsequent diversion.

Review of transport airplane AFM's also shows that, in all cases, specific procedures for ***multiple*** engine impending bypass indications are not provided. In the past, it was determined that the flightcrew would respond to the indication through basic piloting skills and judgment, involving factors such as phase of flight, alternate airport weather conditions, etc. Review of the service data noted above shows that many flightcrews monitor fuel filter indications and make flight planning decisions despite there not being a definite procedure in the AFM.

The Transport Airplane Directorate has evaluated specific procedures needed following impending fuel filter bypass indications: In addition to immediate crew awareness of impending engine fuel filter bypass, the AFM should contain a flightcrew procedure that requires landing at the nearest suitable airport, if ***multiple*** engine fuel filter bypass is indicated. The FAA is considering rulemaking to mandate inclusion of these procedures in transport AFM's.

If you have any questions regarding this subject, please contact **Mike Dostert** of the Transport Airplane Directorate's Airframe and Propulsion Branch at telephone (206) 227-2132. ✠

Policy and Guidance

Fuel Quantity Indicator and Unusable Fuel Requirements: FAR 25.1337(b) Compliance

This article provides information as to the current policy relative to determination of the unusable fuel quantity for showing compliance with section 25.1337 of the Federal Aviation Regulations (FAR).

Section 25.1337(b)(1), "*Powerplant Instruments*," states:

Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under section 25.959 ["*Unusable Fuel Supply*"].

The phrase, "*during level flight*," apparently has caused some confusion in how to determine the unusable fuel quantity correctly.

As stated in section 25.959, the unusable fuel must be established under the most adverse fuel feed configuration for all intended operations and flight maneuvers involving fuel feed from that tank. The intended usage range should be established by the applicant based on flight characteristics of the particular airplane type. For example, an auxiliary tank that is normally depleted of fuel during cruise may use the normal cruise attitudes based on analysis of allowable airplane center of gravity configurations to establish the unusable fuel for the tank. For a main fuel tank that may be used during takeoff, climb, approach, and landing, the worst attitude within those flight regimes must be used. The applicant may choose to limit the allowable airplane nose up/down and roll attitudes by providing an Airplane Flight Manual (AFM) limitation for low fuel operations, to reduce the unusable fuel quantities. However, these limitations must be found to be operationally acceptable for the specific airplane type during flight conditions that are likely to exist during a low fuel state.

Once the intended usage range has been established, the applicant must define attitude versus unusable fuel quantity relationships for each tank. These analytically determined relationships must be validated during flight and or ground test. The unusable fuel (per section 25.959) should be determined by flight testing at the point where the maximum unusable fuel would exist within the intended usage range of the tank.

The fuel indicator system should be calibrated to read zero at this value.

Fuel tank indication errors for level flight and for coordinated maneuvers should be consistent with the guidance provided in policy memorandum "*Standards for Transport Airplane Fuel Quantity System Accuracy*," dated May 30, 1984. This memorandum references MIL Specification MIL-C-26988C, "*Military Specification for Gage, Liquid Quantity, Capacitance Type, Transistorized*," which states that complete gauge system error at room temperature shall not exceed two percent of the indication plus one percent of full scale indication.

In addition to this guideline, each system should be reviewed to show that no unsafe condition could result due to high indication errors. Large errors, particularly errors that result in false high readings, and the inability to accurately predict remaining reserves or detect a fuel leak within the fuel system, should not be allowed.

If you have any questions on this particular issue, please contact **Mike Dostert** of the Transport Airplane Directorate's Airframe and Propulsion Branch at telephone (206) 227-2132. ✠

Policy and Guidance

Uncontained Engine Failure Certification Requirements

During recent certification review of an airplane with aft fuselage-mounted engines, the FAA became aware that loss of rudder function during takeoff could result in loss of airplane control. The rudder was controlled via a single cable routed through the uncontained engine debris zone. A separate electrical rudder trim system allowed for control of the airplane in the remainder of the flight envelope, if the rudder cable were severed during an uncontained engine failure. The FAA questioned how the minimization techniques described within AC20-128 had been incorporated into the airplane design. The applicant's position was that the design was identical to a previously approved design and that the exposure time of 20 seconds was of short duration; therefore, the hazard had been minimized.

During discussions with the FAA, the General Aviation Manufacturers Association (GAMA) requested information regarding the history of compliance practices used to "minimize the hazard following an uncontained engine failure," as specified in section 25.903(d) ("*Engines*") of the Federal Aviation Regulations (FAR); and the basis for current FAA guidance regarding compliance with this regulation. In addition, GAMA expressed the position that new guidance should not be applied to certification projects for derivatives of existing aircraft designs.

The purpose of this article is to provide a better understanding of FAA policy regarding application of regulations, and how this guidance for compliance to the requirements of section 25.903 has evolved.

The Transport Airplane Directorate philosophy regarding guidance on particular regulations is that service experience must be considered in any compliance finding. Numerous reviews of FAA practices have established there can be no excuse for ignoring service experience.

The recent meeting on aviation safety, hosted by Department of Transportation Secretary Federico Peña in Washington DC., was prompted by several recent accidents that resulted in diminished public faith in the safety of the air transportation system. That meeting re-emphasized that safety-significant problems need to be anticipated and corrected before an accident occurs. The public expectation is that the FAA will consider service experience and learn from it when setting certification standards. This inevitably results in changes in the guidance and compliance methodology as deficiencies are discovered. For example, although a design may have been acceptable to the FAA 10 years ago, the acceptability of the design may be affected by lessons learned from transport fleet experience.

We recognize that this may require extra effort on the part of the manufacturer, but we cannot rest on the certification laurels earned for designs created 5, or in some cases 25, years ago. The accident record of today has been achieved by a process of continuous improvement. Airplane customers demand this in operating costs, utility and other design features. Should less be expected regarding safety considerations?

The requirement of section 25.903(d)(1) is similar to many of the FAR's in that the regulation is stated in objective terms that are general in nature, and the compliance methodology is contained in Advisory Circulars (AC). The concept of objective regulations and more definitive guidance material allows the manufacturers the maximum latitude in design. However, in certain instances, manufacturers believe that if the regulation does not specifically state a design requirement, the airplane manufacturer does not need to consider other factors for compliance.

Compliance to section 25.903(d)(1) is a good example of an objective regulation and a general Advisory Circular that does not dictate design. For example, the AC advocates redundant and separated flight critical controls. No requirement is specifically stated in the rule or the AC for redundant rudder cables in the uncontained engine debris zone. The reason for this is that, in many instances, the rudder is not flight critical because of flight characteristics of the airplane or automatic rudder bias systems incorporated to eliminate the need for a redundant system.

A discussion of current FAA guidance regarding compliance with uncontained engine failure requirements of section 25.903 for airplane rudder systems follows.

Section 25.903 (d) Regulatory History

The historical record shows that the requirement to *"minimize the hazard following an uncontained engine failure"* was first applied in the late 1960's, via a special condition, to airplane models such as the Boeing 747 and the McDonnell Douglas DC-10. In 1970, section 25.903 was amended to include this requirement.

Section 25.903 does not include specific criteria within the regulation for what is required to "minimize the hazard following an uncontained failure." Guidance was provided in FAA Order 8110.11, *Design Considerations for Minimizing Damage Caused By Uncontained Aircraft Turbine Engine Rotor Failures*, dated November 19, 1975. That guidance was replaced by AC 20-128, *Design Considerations For Minimizing Hazards Caused by Uncontained Turbine Engine and Auxiliary Power Unit Rotor and Fan Blade Failures*, dated March 9, 1988.

All guidance, to date, has stated that the means used for minimization for the flight control systems includes the use of separated, redundant critical systems. Section 6(b) of Order 8110.11 states:

"One design consideration is to incorporate some degree of redundancy for critical system components located in impact zone areas. This redundancy should provide sufficient physical separation of the critical components to ensure against simultaneous damage of the redundant components following an uncontained rotor failure. For example, one airplane manufacturer of an airplane with aft-fuselage-mounted engines provides two separate hydraulic rudder control systems with one set of components on the forward vertical stabilizer spar and the other system components are mounted on the rear spar."

Each of the subsequent revisions to the guidance for section 25.903 updated what was considered at that point in time, based on technology improvements and improved understanding of the uncontained engine threat, to constitute minimization of the hazard.

Order 8110.11, dated November 19, 1975, states in paragraph 3(e) that:

"FAR 25.903(d) was amended May 1970 to ensure that, for turbine engine installations, design precautions are taken to minimize the hazards to the airplane in the event of an engine rotor failure. This order outlines some of the means found acceptable for minimizing effects of damage caused by uncontained rotor failures. It is important to note, however, that while the means described herein are based on experience, tests, and analyses within the current state of the art, they are not the only means available to the designer."

The main point is that the FAA has been on record since 1970 in stating that the accepted techniques for minimization are dependent upon service experience and the "current state of the art."

The Sioux City DC-10 accident revealed flaws in previous compliance practices and, therefore, the FAA began the process of revising the AC to better emphasize what were considered acceptable practices. The redrafting task subsequently was tasked to an Aviation Rulemaking Advisory Committee (ARAC). The ARAC task group is very close to reaching technical agreement on the latest draft. Cessna and GAMA have had representatives on the ARAC group since its inception in 1992. All discussions within the meeting have focused on the need to minimize the hazard prior to consideration of quantitative analysis methods.

It should be emphasized that the latest draft of the AC being developed within ARAC, like the previous order and AC, specifies the use of separation, redundancy, and shielding as methods of minimization to be used for flight control systems. Separation of critical flight controls by at least the one-third disk dimension is listed as a basis by which an airplane design should be evaluated. However, a requirement for dual rudder cables is not specifically listed because, in many instances, the rudder is not a flight-critical system, even during the takeoff phase, because of flight characteristics of the airplane or automatic rudder bias systems incorporated to eliminate the need for a redundant system.

Current Certification Practices

Since the Sioux City accident in 1989, the FAA has placed greater emphasis on the level of review each airplane has received to assure that separation, isolation, redundancy, and shielding methods for minimization have been utilized.

For example, late in the McDonnel Douglas Model MD-11 type certification, the FAA learned of a noncompliance item of the MD-11 engine fuel shutoff actuation system. Airplane certification was delayed until modification to the engine fuel shutoff system was accomplished. This included a requirement for replacing the single cable routed along the wing leading edge, with an electrically-driven valve with redundant, separated activation wiring routed on the front and rear wing spars. Further, the Airbus Model A340 fuel system design was revised to incorporate an isolation feature such that damage to the fuel tanks would not result in loss of range capability. The Boeing Model 777 engine cowls incorporate shielding to minimize the hazard from smaller debris impacting the opposite engine. The need for each of these modifications was based on in-service events that provided a better understanding of the uncontained engine threat. All of these issues have been included in discussions within the ARAC working group.

With regard to rudder control systems of recently certificated airplanes, the Transport Airplane Directorate sent out a survey to all local Aircraft Certification Offices (ACO) in December 1994. Review of the survey results indicates that the FAA has required applicants for new type certificates to show that the rudder system is not critical or to provide redundant/separated rudder controls on all recent projects (with the exception of the Airbus Model A330/340, which have wing-mounted engines)

The following airplanes provide redundant separated rudder control systems as a means of compliance with FAR 25.903(d):

- Dornier 328
- Saab 2000
- Canadair Regional Jet
- Canadair Challenger
- BAe 4100

The following airplanes have non-critical rudder systems:

- Falcon 2000
- Fokker-series airplanes

In addition, the following airplanes, for which applications for type certification have been received, have dual separated systems:

- Canadair Global Express
- Lear 45
- LET 610
- IAI Galaxy
- Boeing 777

The success of these recently certificated airplanes demonstrates that designs with non-critical rudders, automatic rudder bias systems or dual path rudder control systems within the uncontained engine debris zone are both technically feasible and economically a means to minimize the hazard to the aircraft from an uncontained engine failure. It should also be pointed out that due to the location of the engines on the aft fuselage, in close proximity to the rudder cable, the likelihood of impacting the cables is significantly increased over that of an airplane such as the Boeing Model 767 where the engines are wing mounted.

Service History

Review of the transport airplane service history shows that, in many instances, airplanes with fuselage-mounted engines have experienced extensive damage due to uncontained engine failure.

- A Fokker Model F28 experienced an uncontained fan failure on April 14, 1988, that resulted in rapid decompression of the passenger compartment and impact damage to the opposite engine.
- In 1989, a Ryan Airways Model 727 experienced a hull loss accident when a fuselage-mounted fuel line was severed by an uncontained failure that occurred just prior to V_1.
- On January 20, 1995, a Falcon 20 experienced a hull loss fatal accident when an uncontained fan disk failure occurred during takeoff that resulted in extensive fuselage damage and an uncontrolled fire.
- The most notable incident regarding the rudder system occurred in December 4, 1978, when a Braniff Air Model 727 experienced an uncontained failure during climb out due to engine overspeed. Multiple small fragments impacted the fuselage resulting in severing of the rudder cable and hydraulic lines. The Model 727 is fully controllable throughout the flight envelope without the rudder and, therefore, loss of the rudder was not catastrophic.

As mentioned earlier, the Model DC-10 (Sioux City) accident occurred when a tail-mounted engine damaged critical systems located in close proximity to the engine.

These incidents highlight the need to provide redundant and separated systems, particularly when the systems are located in close proximity to the engine.

Future Certification Criteria

The revision to AC 20-128 currently being developed by ARAC should be released for public availability within the next year. Guidance within the AC should assist the airplane designer, designated engineering representatives (DER), and FAA personnel to understand what measures are considered minimum standards for compliance with section 25.903(d)(1). The Transport Airplane Directorate strongly recommends that certification applicants work closely with the FAA Certification Office early in the process, so that design changes are not needed during the later stages of the certification project.

The Directorate will require redundant separated flight-critical controls within the uncontained engine debris impact area on all future airplanes as described below:

(1) For all new or very recent applications for new type certificate

(2) For projects where application for a new, amended, or supplemental type certificate application has been made that have the following characteristics:

- installation of new or modified engines that substantially increase the hazard to the flight controls because of larger rotor diameters; or
- significant structural modifications in the area of the engine strike zone. ✠

Policy and Guidance

First Update of Aircraft Icing Handbook Issued

The first update of the *Aircraft Icing Handbook* (DOT/FAA/CT-88/8-1,2,3) has been issued. Recent available research and test results have been incorporated in order to make the analytical and test procedures as up-to-date as possible. The incorporation of such recent advances in technology during the preparation of the handbook has required examination of past and present procedures, as well as field experience. In these procedures, simplifying assumptions to make analyses possible, imperfect simulations are required and demonstration tests are not always sufficiently specific or well correlated. Thus, engineering judgment must be used to provide the conservatism required in design, analysis, and test to compensate for uncertainties.

Many of the changes are in response to comments from users of the handbook. These comments were greatly appreciated, and further comments on the updated handbook will be equally welcome. The FAA expects to update this handbook on a periodic basis as a result of continuing research and development in the field.

To submit comments or obtain copies of this handbook, contact the National Technical Information Services, Springfield, Virginia 22161, telephone (703) 487-4650. ✠

Momentary Power Interruption Test Requirements for Technical Standard Order C129

In the past few months, the FAA's Engineering Division in Washington, DC., has received several requests for clarification of the power interruption testing requirements of Technical Standard Order (TSO) C129, *Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS).*

TSO-C129 refers to Radio Technical Commission of America (RTCA) documents:

- **RTCA/DO-208** for GPS navigation equipment Minimum Operational Performance Standards (MOPS), and
- **RTCA/DO-160C** for environmental testing.

Section 2.4.13 (*"Power Input Tests"*) of RTCA/DO-208 refers to Sections 16.5.1 and 16.5.2 of RTCA/SO-160C.

These requirements apparently are somewhat vague on the exact nature of the criteria for passing the test. We are now aware that many applicants for not only GPS equipment, but other equipment as well, have interpreted this requirement in different ways.

The FAA has conducted a careful review of this standard and has consulted with the FAA's National Resource Specialists for Flight Management and for Advanced Avionics/Electrical. This review has resulted in the following guidance, effective immediately:

a. For all TSO's that require testing to RTCA/DO-160C, Sections 16.0 and 17.0, the sentence, "After exposure, ***determine compliance with applicable equipment performance standards. . .***" is considered to refer to the appropriate section of the RTCA MOPS that references RTCA/DO-160C. For example, Paragraph 2.4.13.1 of RTCA/DO-208 (GPS MOPS) is the applicable performance standard referenced by RTCA/DO-208 Paragraph 16.5.1.4.b.

b. For a test of a MOPS that is titled "Normal Operating Conditions," the applicable equipment standards should be met while the test is being conducted. If the equipment experiences an interruption of operation as a result of the test, such as a momentary power loss, then the acceptability of the duration of the interruption will depend on the intended function of the equipment and must be justified.

c. For GPS-based Navigation Systems, the FAA has determined that the maximum allowable time to reestablish a valid navigation position is **five seconds**. This reacquisition period is considered normal operation. Therefore, the navigation failure flag(s) or annunciation(s) should not be displayed, and the equipment must not present misleading information to the flight crew.

d. Manual resets or pilot actions required to restore normal operation following any test must be explicitly permitted by the applicable TSO or MOPS. If the TSO or the referenced MOPS does not specifically allow for a reset, then the equipment must continue to operate or resume normal operation without any pilot action.

If any further clarification of these testing requirements is needed, please contact **Jim Williams** [telephone (202) 267-9562] or **Heinz Mueller** [telephone (202) 267-7776] of the FAA's Aircraft Certification Service in Washington, DC; or write them at:

Federal Aviation Administration
Aircraft Certification Service,
AIR-120
800 Independence Avenue SW.
Washington, DC 20591

New "NOTE" in AD's Concerning Applicability

As a result of recent communications with the Air Transport Association (ATA) of America, the FAA learned that some operators may misunderstand the legal effect of airworthiness directives (AD) on products that are identified in the *applicability statement* of the AD, but that have been modified, altered or repaired in the area addressed by the AD.

The FAA points out that all products identified in the applicability statement of an AD are legally subject to the AD. If a product has been modified, altered or repaired in the affected area in such a way as to affect compliance with the AD (that is, such that the requirements of the AD cannot be accomplished as stated in the AD), the owner or operator is required to obtain FAA approval for an alternative method of compliance (AMOC) with the AD, in accordance with the paragraph of each AD that provides for such approvals.

To remind operators of this, a NOTE has been added to appropriate AD's, which reads as follows:

> ***NOTE*** *: This AD applies to each airplane identified in the preceding applicability provision, regardless of whether it has been modified, altered, or repaired in the area subject to the requirements of this AD. For airplanes that have been modified, altered, or repaired so that the performance of the requirements of this AD is affected, the owner/operator must use the authority provided in paragraph (xx) of this AD to request approval from the FAA. This approval may address either no action, if the current configuration eliminates the unsafe condition; or different actions necessary to address the unsafe condition described in this AD. Such a request should include an assessment of the effect of the changed configuration on the unsafe condition addressed by this AD. In no case does the presence of any modification, alteration, or repair remove any airplane from the applicability of this AD.*

Because of numerous questions that have surfaced about this new NOTE, this article is intended to clarify not only the language of the NOTE, but its intent, as well.

Not New Policy

It is important first to emphasize that the information provided in the NOTE does **not** constitute any new policy or change in policy. It is merely a restatement of current law as to the legal effect of the applicability of AD's.

The *applicability statement* of AD's has always identified what products must comply with the AD. In accordance with Federal Aviation Regulations (FAR) section 39.3, operators whose products are subject to an AD must operate those products in accordance with the requirements of that AD. If an operator is unable to operate the product in accordance with the AD, it either must not operate it, or must obtain an approval for an alternative method of compliance with the AD in order to operate it.

It is also important to emphasize that there is no regulatory provision that allows an operator to make a discretionary determination, based on unstated criteria, as to whether or not it needs to comply with an AD when its product is listed in the applicability of the AD. Allowing such discretion would jeopardize the enforceability of every AD.

Why NOTE is Necessary

The inclusion of this NOTE in AD's was not the result of any one singular case. The FAA had been concerned for quite some time about what appeared to be a *general* misunderstanding in the industry of the legal effect of AD's on airplanes specified in the applicability statement of AD's. This concern was based on information that the FAA had received from airline organizations, which indicated that operators' understanding of this particular issue was not uniform. Responses to the NOTE from several operators have confirmed the validity of these concerns.

Although every effort was made to keep the language simple and clear, the FAA has received questions concerning the meaning of the phrase, "*. . . the performance of the requirements of this AD is affected.*" Performance of the requirements of an AD is "*affected*" if an operator is unable to perform those requirements in the manner described in the AD. For example, if the AD requires a visual inspection in accordance with a certain service bulletin, and the operator cannot perform that inspection because of the placement of a repair doubler over the structure to be inspected, then *"performance of the AD is affected."*

In addition, performance of the requirements is *"affected"* if it is physically possible to perform the requirements, but the results achieved are different from those specified in the AD. For example, if the AD requires a non-destructive test (NDT) inspection in accordance with a certain service bulletin, and the operator is able to move the NDT probe over the specified area in the specified manner, but the results are either meaningless or inaccurate because of a repair doubler placed over that area, then *"performance of the AD is affected."*

While the NOTE itself is not capable of addressing every possible situation, *"affected"* is normally an easy standard to apply: either the requirements specified in the AD can be performed and achieve the specified results, or they cannot.

Responsibilities of Operators

The FAA has received several comments from members of the aviation industry contending, "Whether or not performance of an AD is *affected* should be left to the discretion of the operator."

The FAA has responded to each of these by saying that, providing operators with the discretion to determine whether or not an AD is applicable to an airplane with altered structure is equivalent to allowing the operator to make a determination that an alteration has eliminated the unsafe condition addressed by the AD. Only an engineering evaluation, based on review of applicable type design data, can determine whether or not an unsafe condition exists on an aircraft as a result of altered structure. In some cases, an alteration may actually aggravate an unsafe condition, so that the AD requirements may be insufficient; in other cases, it may have no effect at all on the unsafe condition. However, it is only by way of a detailed engineering evaluation that this can be determined.

Policy and Guidance

Aviation Rulemaking Advisory Committees (ARAC): Update of Activities

What is ARAC?

The Aviation Rulemaking Advisory Committee (ARAC) is a formal standing committee, comprised of representatives from aviation associations and industry. Established by the FAA Administrator on February 15, 1991, ARAC provides industry input in the form of information, advise, and recommendations to be considered in the full range of FAA rulemaking activities. The ARAC charter is reviewed approximately 15 months after the charter's most recent extension to determine the need to continue ARAC.

What are ARAC's objectives?

The desired objectives of ARAC are to:

1. Gain public input early in the rulemaking process.
2. Improve rules by involving interested members of the public in their development.
3. Include the concerns and opinions of the public in the document, thereby reducing the probability of non-supportive public comments in response to the rulemaking document publication and issuance.
4. Move rules through the rulemaking process more quickly.
5. Avid placing any unnecessary burden on the public because of lack of information.

What does ARAC do?

ARAC provides rulemaking advice and recommendations with respect to aviation-related issues to the FAA Administrator, through the Associate Administrator for Regulation and Certification. The exchange of ideas that occurs through the ARAC process affords the FAA additional opportunities to obtain firsthand information and insight from those parties who are most affected by existing and proposed regulations. ARAC expedites the development, revision, or elimination of rules without circumventing the public rulemaking process and procedure.

Who tasks ARAC? The FAA tasks ARAC. ARAC may accept or decline the task offered. Once the task is accepted, ARAC may not modify the task without approval by the FAA. ARAC may recommend new tasks to the FAA; however only tasks assigned of approved by the FAA and published in the **Federal Register** may be undertaken. In the conduct of its activities, ARAC complies fully with the provision of the Federal Advisory Committee Act (FACA) and administrative directives of the FAA that pertain to advisory committees.

Who are the ARAC members?

ARAC is composed of approximately 65 members, representing a broad spectrum of aviation interests and possessing sufficient diversity to provide a balanced range of views and expertise. The membership of ARAC consists of representatives from numerous national associations, universities, and aviation-related industries. An executive director from the FAA serves as the Designated Federal Official (DFO), as required by FACA, but is not a member of ARAC.

ARAC Management. ARAC is managed by a Chair, a Vice-Chair, and Assistant Chairs. When ARAC meets on general subject matter, the meeting is chaired by the ARAC Chair. When ARAC meets on specific subject matter, the meeting is chaired by the designated Assistant Chair possessing knowledge/experience in that subject matter. Through this organizational structure, ARAC focuses simultaneously on 12 areas representing a broad cross-section of aviation issues.

Executive Committee. The overall administration of ARAC is by an Executive Committee, chaired by the ARAC Chair. Additional Executive Committee members include the ARAC Vice-Chair, ARAC, the ARAC Assistant Chairs (each responsible for a broad technical issue, a representative from a public interest group, the Joint Aviation Authority (JAA) Regulations Director, FAA's Director of the Office of Aviation Policy, Plans, and Management Analysis (APO), and a representative from FAA" Office of the Chief Counsel (AGC).

Working Groups. To assist in its work, ARAC, from time to time, may form working groups to act as staff to ARAC. These working groups consist of volunteer ARAC members, volunteers from the interested general public, and a representative from the FAA office of primary interest (OPI) most closely associated with the subject matter being addressed by the working group. Each member contributes his/her particular knowledge or experience to task completion and subsequent formulation of alternative recommendations to ARAC. All working group work is reviewed by ARAC. ARAC evaluations working group contributions and approves or disapproves their incorporation in to ARAC's recommendations to the FAA. Working groups function under the administrative control of an appointed Working Group Chair who reports to ARAC.

How does FAA support ARAC?

To enable ARAC to function certain organizational support is required on a continuing basis. The FAA provides this organizational support to ARAC through its Office of Rulemaking (ARM) and the office of primary interest. the OPI is that office, within the FAA, that has the most interest and expertise in the project area or that has requested that ARAC address the tasked subject matter.

What are the Working Groups currently working on?

The following gives a brief update of the activities of current ARAC Working Groups tasked with issues relative to transport category airplanes:

Flight Test Working Group

Working Group Chair:
Reg Grantham, Boeing

Task 1 - *AIA/AECMA Petition for Rulemaking:* Make a recommendation to the ARAC Transport Airplane and Engine Interest Group concerning the disposition of the joint Aerospace Industries Association of America, Inc. (AIA), and Association Europenne des Constructeurs de Material Aerospatial (AECMA) petition for rulemaking dated May 22, 1990. These issues relate to harmonization of the strength of pilots table of maximum control forces and associated advisory material; harmonization of FAR/JAR maneuverability requirements and associated material; and harmonization of the minimum control speed requirements of the FAR/Joint Airworthiness Regulations (JAR). [FAR Sections 25.143(c), 25.143(f), 25.149, 25.201.]

Status: *FAA has developed a final rule, which is now in final coordination in FAA headquarters.* ***Federal Register*** *publication is expected this year.*

Task 2 - *Gate Requirements for High Lift Devices*: Recommend to the ARAC simplified and clarified requirements related to gated positions on the control used by the pilot to select the position of an airplane's high lift devices.

Status: *Working group has developed a draft Notice of Proposed Rulemaking (NPRM), as well as changes to Advisory Circular (AC) 25-7, "Flight Test Guide for Certification of Transport Category Airplanes," which are being reviewed both within the working group and by the FAA internal team.*

Task 3 - *Flight Characteristics in Icing Conditions*: Recommend to the ARAC new or revised requirements and compliance methods related to airplane performance and handling characteristics in icing conditions.

Status: *Project is in its early planning stages.*

Loads and Dynamics Harmonization Working Group

Working Group Chair:
Vic Card, Civil Aviation Authority (CAA), United Kingdom

Task 1 - *General Design Loads:* Develop new or revised requirements and associated advisory and guidance material for the general design loads for transport category airplanes. (FAR Sections 25.331, 25.335, 25.341, 25.345, 25.351, 25.371, 25.427, 25.483, 25.511, 25.561, 25.963, and other conforming changes)

Status: *Recommendation was submitted from the ARAC to the FAA on February 27, 1995, and is undergoing FAA review.*

Task 2 - *Engine Torque and Gyroscopic Loads*: Develop new or revised requirements and associated advisory and guidance material for determining the design loads for engine seizure conditions. (FAR Sections 25.361, 25.371, and other conforming changes)

Status: *Working group is in the initial drafting stages of their recommendation.*

Task 3 - *Flutter, Deformation, and Fail-Safe Criteria:* Develop new or revised advisory and guidance material for flutter, deformation, and fail-safe criteria. (FAR Section 25.629)

Status: *Working group is in the initial drafting stages of their recommendation.*

Task 4 - *Interaction of Systems/ Structure*: Review existing special conditions for fly-by-wire airplanes and existing requirements for control systems, including automatic and/or power-operated systems, and recommend any new or revised general requirements needed for flight control systems and structures affected by those systems (FAR Sections 25.302, 25.671, 25.1329, Part 25 Appendix K).

Status: *Working group is in the initial drafting stages of its recommendation.*

Task 5 - *Continuous Turbulence Loads:* Review the requirement for the continuous turbulence standard in light of the ARAC proposal for a tuned discrete gust requirement in order to determine whether the continuous turbulence requirement should be revised or removed from the FAR/JAR for better consistency with the new proposed tuned discrete gust criteria. [FAR Section 25.305(d)]

Status: *Working group is in the initial drafting stages of its recommendation.*

Task 6 - *Strength and Deformation:* Review the recent requirements adopted in the FAR by Amendment 25-77 (for the design of transport airplanes against buffet and forced structural vibrations) and consider appropriate changes for the JAR and FAR to harmonize these rules. [FAR Sections 25.305(e) and (f)]

Status: *Working group is in the initial drafting stages of their recommendation.*

Task 7 - *Design Flap Speeds:* Review the current flap design loads requirements to resolve differences in interpretation between the FAA and the JAA concerning the structural design stall speeds on which the flap design speeds are based. Recent measurements of gust speeds at low altitudes, where flaps are normally extended, indicate a more severe gust environment may be present. Review all aspects of the flap design load requirements, including the design airspeeds, vertical and head-on design gust criteria, and the effects of automatic retraction and load relief systems. [FAR Section 25.335(e)]

Status: *Working group is reviewing issues.*

Task 8 - *Residual Strength Loads for Damage Tolerance:* Review the differences in residual strength design load requirements between the FAR and JAR and resolve differences to harmonize this rule. Prepare an NPRM or make recommendations to other ARAC efforts concerning FAR Section 25.571, so that they can be included in rulemaking that may be forthcoming from those efforts. [FAR Section 25.571(b)]

Status: *Working group is reviewing issues.*

Task 9 - *Shock Absorption Tests:* Review the changes recently introduced into the JAR that have resulted in differences between the FAR and JAR in regard to the requirement for shock absorption tests. Review those changes in view of harmonizing the FAR and JAR. [Section 25.723(a)]

Status: *Working group is developing draft advisory material.*

Task 10 - *Rough Air Speed:* The ARAC has proposed a new Section 25.1517 concerning rough air speed design standards in its proposal for a tuned discrete gust requirement. This action is harmonized with the current JAR 25.1517; however, further changes in the rough air speed requirement may be needed in both the FAR and JAR. Review JAR 25.1517 and the new proposed FAR 25.1517 to determine if further changes are needed. [Section 25.1517]

Status: *Project is in its early planning stages.*

Task 11 - *Taxi, Takeoff, and Landing Roll:* Prepare an advisory circular that establishes criteria that may be used to calculate rough runway and taxiway loads, as required by Section 25.491, 25.235, 25.305.

Status: *Project is in its early planning stages.*

Task 12 - *Braked Roll Condition:* Review the provisions of Section 25.493 of the FAR and JAR concerning the braked roll condition and finalize a harmonized notice of proposed rulemaking.

Status: *Working group has completed a draft NPRM, including preliminary economic evaluation, which is currently being reviewed by the FAA internal team.*

General Structures Harmonization Working Group

Working Group Chair:
Herb Lancaster, Boeing

Task 1 - *Bird Strike Damage:* Develop new or revised requirements for the evaluation of transport category airplane structure for in-flight collision with a bird, including the size of the bird and the location of the impact on the airplane. (FAR Sections 25.571, 25.631, 25.775)

Status: *Working group is in the initial drafting stages of its NPRM.*

Task 2 - *Safe Life Scatter Factor:* Develop recommendations for new or revised advisory and guidance material concerning the safe life scatter factors. (FAR Section 25.571)

Status: *Working group has developed an initial draft of a change to AC 25.571-1A, "Damage-Tolerance and Fatigue Evaluation of Structure." This change addresses the evaluation of of scatter factors for the determination of life for parts categorized as safe-life.*

Task 3 - *Proof of Structure:* Review Title 14 CFR, Section 25.307, corresponding paragraph 25.307 of the JAR, and supporting policy and guidance material, and recommend to the FAA appropriate revisions relative to the issue concerning limit load tests, ultimate load tests, and structural testing for harmonization, including advisory material. (FAR Section 25.307)

Status: *Working group is reviewing issues.*

Task 4 - *Material Strength Properties and Design Values:* Review Title 14 CFR, Section 25.613, corresponding paragraph 25.613 of the European JAR and supporting policy and guidance material, and recommend to the FAA appropriate revisions for harmonization, including advisory material.

Status: *Working group is reviewing issues.*

Task 5 - *Damage Tolerance and Fatigue:* Review Title 14 CFR, Section 25.571, and corresponding paragraph 571 of the JAR and supporting policy and guidance material and recommend to the FAA appropriate revisions for harmonization including advisory material.

Status: *Working group is reviewing issues.*

Installation Harmonization Working Group

Working Group Chair:
Dave Gordon, McDonnell Douglas

Task 1 - *Installations (Engines):* Develop recommendations concerning new or revised requirements for the installation of engines on transport category airplanes and determine the relationship, if any, of the requirements of FAR 25.1309 to these engine installations. (FAR Section 25.901)

Status: *Working group is in initial drafting stages of its recommendation.*

Task 2 - *Windmilling Without Oil:* Determine the need for requirements for turbine engine windmilling without oil. (FAR Section 25.903)

Status: *Working group is in initial drafting stages of its recommendation.*

Task 3 - *Non-contained Failures:* Revise advisory material on non-contained engine failure requirements (FAR Section 25.903 and related provisions of FAR Parts 23, 27, 29, 33, and 35, as appropriate; AC 20-128).

Status: *The working group is reviewing a preliminary draft AC prepared by the Task Group. The Task Group is also studying several complex issues that may result in yet another AC revision.*

Task 4 - *Thrust Reversing Systems:* Develop recommendations concerning new or revised requirements and guidance material for turbojet engine thrust reversing systems. (FAR Section 25.933)

Status: *The Task Group has developed a preliminary draft NPRM/NPA and AC/ACJ proposal, which was presented to the Working Group for review.*

Seat Testing Harmonization Working Group

Working Group Chair:
Dean Klippert, Douglas Aircraft

Task: Make recommendations to the ARAC Transport Airplane & Engine Interest Group concerning the requirements and guidance material for the certification of flightcrew seats and the associated test conditions. (FAR Section 25.562; AC 25.562A)

Status: *A draft revision of the AC is nearly complete.*

Cargo Standards Harmonization Working Group

Working Group Chair:
Dean Klippert, Douglas Aircraft

Task: Make recommendations to the ARAC Transport Airplane & Engine Interest Group concerning new or revised requirements for main deck Class B cargo compartments, a subject which has recently been coordinated between the JAA and FAA.

Status: *Working group is in the initial drafting stages of its recommendation.*

Direct View Harmonization Working Group

Working Group Chair:
Dean Klippert, Douglas Aircraft

Task: Review the proposed guidance material contained in FAA draft Advisory Circular 25.785 for finding compliance with the cabin attendant's direct view requirements of FAR 25.785 and make recommendations to the ARAC Transport Airplane & Engine Interest Group for new or revised guidance. (FAR Section 25.785; AC 25.785)

Status: *Working group is reviewing issues.*

Hydraulic Test Harmonization Working Group

Working Group Chair:
Jim Draxler, Boeing

Task: Make recommendations concerning new or revised requirements for hydraulic systems and the associated test conditions for hydraulic systems installed in transport category airplanes. (FAR Section 25.1435)

Status: *A draft NPRM and AC have been developed and are undergoing final working group review.*

Systems Design and Analysis Harmonization Working Group

Working Group Chair:
Ed Schroeder/Jean-Claude Boquet

Task: Develop guidance material concerning the evaluation and control of certification maintenance requirements created to satisfy the requirements of FAR 25.1309 for newly certificated transport category airplanes.

Status: *ARAC recommendation forwarded to the FAA on July 14, 1994; AC 25-19 issued by the FAA on November 29, 1994. This working group action is now complete.*

Airworthiness Assurance Working Group

Working Group Chair:
Ron Wickens, Federal Express

Task 1 - *Structural Modifications*: Conduct periodic reviews of manufacturer service bulletins to determine whether new or revised structural modifications or inspections should be instituted and made mandatory as the airplane ages beyond its original design life goal. This review should cover the following airplanes: Airbus A-300, British Aerospace BAe 1-11, Boeing B-707, B-727, B-737, B-747, Douglas DC-8, DC-9/MD-80, DC-10, Fokker F-28, and Lockheed L-1011.

Status: *This action is considered complete.*

Task 2 - *Corrosion:* Develop recommendations concerning whether new or revised requirements and compliance methods for corrosion prevention and control programs should be instituted and made mandatory for the Airbus A-300, British Aerospace BAC 1-11, Boeing B-707, B-727, B-737, B-747, Douglas DC-8, DC-9/MD-80, DC-10, Fokker F-28, and Lockheed L-1011.

Status: *Airworthiness Directive action complete for all models. Action on this task is now considered complete by the Working Group.*

Task 3 - *Repairs:* Develop recommendations concerning whether new or revised requirements and compliance methods for structural repair assessments of existing repairs should be instituted and made mandatory for the Airbus A-300, British Aerospace BAC 1-11, Boeing B-707, B-727, B-737, B-747, Douglas DC-8, DC-9/MD-80, DC-10, Fokker F-28, and Lockheed L-1011.

Status: *The Working Group has developed a draft NPRM and associated advisory circular, which are currently under review by the FAA internal team.*

Task 4 - *Structural Fatigue Audit:* Develop recommendations on whether new or revised requirements for structural fatigue evaluation and corrective action should be instituted and made mandatory as the airplane ages past its original design life goal.

Status: *Recommendation in the form of a draft revision to Advisory Circular 91-56, "Structural Fatigue Evaluation for Aging Airplanes," as forwarded to the FAA on July 14, 1994. This document is currently under review within the FAA.*

Task 5 - *Supplemental Structural Inspection Document*: Conduct a review of existing supplemental structural inspection programs to determine whether any new or revised requirements should be instituted and made mandatory as the airplane ages past its original design life goal. This review should cover the following airplanes: Airbus A-300, British Aerospace BAC 1-11, Boeing B-707, B-727, B-737, B-747, Douglas DC-8, DC-9/MD-80, DC-10, Fokker F-28, and Lockheed L-1011.

Status: *ARAC review of this issue is considered complete. Manufacturers are completing final documents.*

Braking Systems Harmonization Working Group

Working Group Chair:
Robert Amberg, Boeing

Task: Recommend to the ARAC new or revised requirements for approval of brakes installed on transport category airplanes. The product of this exercise is intended to be a harmonized standard, acceptable to both the FAA and the JAA.

Status: *Working group is studying issues.*

Performance Standards Working Group

Working Group Chair:
Jay Anema, Boeing

Task 1: Make a recommendation to the ARAC Emergency Evacuation Interest Group concerning whether new or revised standards for emergency evacuation can and should be stated in terms of safety performance rather than as specific design requirements. Specifically, the working group should address the following issues as a minimum:

- Can standards stated in terms of safety performance replace, supplement, or be an alternative to any or all of the current combination of design and performance standards that now address emergency evacuation found in parts 25 and 121 of the FAR.
- If a performance standard is recommended, how can the FAA evaluate a minor change to an approved configuration, or a new configuration that differs in either a minor or a major way from an approved configuration.

Task 2: Make a recommendation to the ARAC Emergency Evacuation Interest Group concerning new or revised emergency evacuation requirements and compliance methods that would eliminate or minimize the potential for injury to full-scale demonstration participants.

Status: *The recommendation developed by the working group in response to Task 2 is undergoing review at the Office of the U.S. Secretary of Transportation (OST).*

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Designee News

New Changes in Designee Standardization Seminars

New changes have been made to the designee standardization training seminars. There are now three separate seminars offered. The three seminars offered are:

(1) The initial Designee Standardization Seminar;

(2) The recurrent Designee Standardization Seminar; and

(3) Designated Alteration Seminar.

The initial Designee Standardization Seminar will only be offered in the Oklahoma City, Oklahoma area four times annually. This seminar will consists of extensive coverage of material relative to Federal Aviation Regulations (FAR), FAA publications, conformity, exports and airworthiness certification. It would be beneficial for new designees to attend this seminar; however, this is not a mandatory requirement.

The recurrent Standardization Seminar has been condensed to two days. This seminar will commence on a Tuesday. Both Tuesday and Wednesday will address the same issues regarding conformity and Export of Class II & III products. Designees will have a choice of which of these days they want to attend the initial class day. The second day, Thursday, will address

Continued on page 55

Recently Issued FAA Rulemaking

Notice 94-29, "Revised Discrete Gust Load Design Requirements."

- Published September 16, 1994.
- The public comment period closed December 15, 1994.

In this notice, the FAA proposes to revise the gust load design requirements for transport category airplanes to: (1) replace the current discrete gust requirement with a new requirement for a discrete tuned gust; (2) modify the method of establishing the design airspeed for maximum gust intensity; and (3) provide for an operational rough air speed. These proposed changes are intended to provide a more rational basis to account for the aerodynamic and structural dynamic characteristics of an airplane, and would also provide for harmonization of the discrete gust requirements with the Joint Aviation Requirements (JAR) of Europe, as recently amended.

Notice 95-1, " Revised Access to Type III Exits."

- Published January 30, 1995.
- The public comment period closed May 1, 1995.

This notice contains a proposed revision to the Federal Aviation Regulations (FAR) that would adjust the recently adopted requirements for access to Type III emergency exits (typically smaller over-wing exits) in transport category airplanes with 60 or more passenger seats. These adjustments reflect additional data derived from a series of tests conducted at the FAA's Civil Aeromedical Institute (CAMI) subsequent to the adoption of these requirements, and are intended to relieve an unnecessary economic burden on the regulated public. The proposed amendments would be applicable to air carriers and commercial operators of transport category airplanes, as well as the manufacturers of such airplanes.

Notice 84-17A, " Fuel System Vent Fire Protection."

- Published February 2, 1995.
- The public comment period closed June 2, 1995.

In this notice, the FAA proposes to amend the airworthiness standards for transport category airplanes to require fuel system vent protection during post-crash ground fires.

This proposal is the result of information obtained from public hearings on aircraft fire safety, and recommendations by the Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee. Its requirements are intended to provide protection against a fuel tank explosion following a post-crash ground fire. This proposed amendment would be applicable to air carriers, air taxi operators, and commercial operators of transport category airplanes, as well as the manufacturers of such airplanes.

Amendments No. 25-83, 121-247, 135-55; "Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins."

- Published February 2, 1995.

These amendments clarify standards adopted in 1986 concerning the flammability of components used in the cabins of certain transport category airplanes. This action was taken to preclude costly, unintended changes to airplane interiors. The clarifications, which are applicable to air carriers, air taxi operators, and commercial operators, as well as manufacturers of such airplanes, will result in more appropriate consistent application of those standards.

Advisory Circular (AC) 25-19, "Certification Maintenance Requirements"

- Issued November 28, 1994

This AC provides guidance on the selection, documentation, and control of Certification Maintenance Requirements (CMR). This document also provides a rational basis for coordinating the Maintenance Review Board (MRB) and CMR selection processes in order to minimize the impact of CMR's on airplane operators.

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Challenge 2000

On July 13, 1995, **Federal Aviation Administrator David R. Hinson** announced *CHALLENGE 2000* — a comprehensive review of the FAA's regulation and certification capabilities. Hinson said the review is essential to determine what the agency will need to do to overcome the increasing challenges of regulating the aviation industry and certifying rapidly changing technologies as America enters the 21st century.

To help the FAA respond to those emerging challenges and reach the goal of zero accidents, Hinson commissioned a high-level task force to "take a fresh look at the way we do things," by conducting a thorough review of the agency's regulation and certification policies and procedures. Hinson, who has set a July 26 deadline for the first meeting of the task force, said he expected it to take approximately 6 to 9 months to complete the review.

When he took the job as FAA administrator two years ago, Hinson said his mandate from **President Clinton** and **Transportation Secretary Federico Peña** was to evaluate the structure and function of the agency, to fix any existing problems he might find, to redefine and reorganize as necessary, and to fine-tune processes and organizations as appropriate. *CHALLENGE 2000* is part of that third phase, he said, and a logical extension of other management initiatives the FAA has undertaken since his arrival.

"Good management requires us to reassess our way of doing business periodically, to ask and answer certain fundamental questions, and to examine the relationship between the way we do things and our reason for doing them," said Hinson. "The only assumption we're starting with is that it's always possible to do a better job. We want to take a hard look at every aspect of our regulation and certification work — not only what we do, but also how and why we do it."

The *CHALLENGE 2000* task force will be chaired by **Barry Valentine**, FAA assistant administrator for policy, planning and international aviation. The task force and the *CHALLENGE 2000* initiative will consist of three components:

- a team of private management consultants and aviation experts, which will conduct an independent examination of regulation and certification processes;
- **Gen. James Abrahamson**, chairman of the FAA Research and Development Advisory Committee, and other advisory committee members under his direction, who will evaluate the FAA's relationship to the technology environment and the agency's ability to respond strategically to rapid technological changes;
- a team of senior FAA officials, whose responsibility will be to assist other members of the task force, to provide essential expertise and perspective on the FAA and its current practices, to facilitate the review, and to carry out Hinson's mandate to "make sure that the FAA is as well prepared tomorrow as we are today to fulfill our mission of ensuring the safety and efficiency of U.S. aviation."

"Like the industry we regulate, the FAA must meet the challenges of tomorrow by planning and preparing for them today," Hinson said.

In addition to the CHALLENGE 2000 review, Hinson said that he and **Anthony Broderick**, Associate Administrator for Regulation and Certification, have been working on several near-term initiatives. Among those initiatives are an aggressive public education program to enhance safety by encouraging passengers to remain seated with seat belts fastened during flights; a fast-track process for the FAA's top five rulemaking initiatives to enhance safety; voluntary accreditation of parts suppliers; and a status report on the safety action initiatives that were developed jointly by government, labor, and industry following the nationwide Safety Summit in January.

Hinson said that several factors figured in his decision to establish a

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FAA's Update to Congress on Designee Oversight

The following material comes from a March 21, 1995, letter to Congressman Oberstar, from Anthony J. Broderick, FAA's Associate Administrator for Regulation and Certification.

Dear Congressman Oberstar:

This letter updates my testimony before the House Committee on Public Works and Transportation, Subcommittee on Aviation on October 20, 1993. That hearing provided our response to the General Accounting Office (GAO) Report, "*Aircraft Certification: New FAA Approach Needed to Meet Challenges of Advanced Technology*," RCED-93-155, September 1993. One recommendation of that report was to, "*define a minimum effective role for FAA in the certification process by in identifying critical activities requiring the agency's involvement or oversight, establishing guidance on the necessary level and quality of the oversight of designated engineering representatives (DER), and developing measures through which staff members' performance and effectiveness can be evaluated.*"

In establishing the guidance on the necessary level and quality of DER oversight, there have been several concurrent activities underway to formalize the oversight process and to ensure that we are giving designees a defined amount of oversight. These efforts are demonstrating positive results. Status of the various activities follows:

DER Oversight

We developed a process that ensures contact with every DER, maintains accountability for that contact, measures the quality of performance of the DER oversight function, and has a measure to determine that DERs are performing in an acceptable manner. The foundation of the new oversight process is a set of key interactions between the DER and FAA that have the highest potential for accomplishing the above goals. These key interactions include identifying and resolving critical technical issues, agreeing on a certification plan and compliance checklist, performing joint project oversight, and correcting significant service difficulties.

The new process requires a closer relationship between the DER and the FAA employee who oversees the DER's work. It formalizes and documents that relationship using traditional performance management tools, such as an annual performance review. An annual systems evaluation of the new process will ensure its effectiveness and continuing improvement. The process is being prototyped now and will be on-line by the end of fiscal year 1995.

The new DER oversight process will increase the amount of time that FAA employees spend doing oversight. That portion of the time that is attributed to formal supervision will be captured and used to revise current staffing standards averages for "*DER Oversight*." However, most of the key interactions are part of routine certification work. FAA employees and DERs work together closely to identify critical technical issues, develop compliance methodology, and witness or conduct tests. These activities are recorded against the "*project*" time. We are planning to conduct a sampling of FAA employees' time to obtain an estimate of how much "*project*" time is actually spent doing "*oversight*." We will provide you the results of that study when they become available.

DER Tracking System

We are developing a national DER database for tracking DER activity. The requirements for this system have been identified and resource planning is underway.

DER Appointment Process

We are completing a prototype phase of new DER appointment process. The first step in making the designee program work is to appoint qualified persons. While the criteria for appointment have been well documented, the process for evaluating compliance with those criteria was not. The new structured process includes documentation and accountability to evaluate the credentials of DER who must reach consensus on appointment.

Of 23 Evaluation Boards held since Feb. 1, 1994, four applicants have been denied appointment. We believe that the process is working to screen out potentially inadequate DERs. In first quarter calendar year 1995, we will assess the results of the prototype against previously gathered baseline data and, if appropriate, recommend national implementation. There are elements of this process that could be applied to the appointment of other designees as well.

DER Renewal Process

This effort further defines the internal process for determining a DER's eligibility for renewal. The new process streamlines and structures the paper flow while firmly establishing criteria and accountability for renewal. A prototype of the new renewal process will begin during the first quarter of calendar year 1995, in conjunction with a new DER oversight process.

DMIR and DAR Oversight

Although not specifically addressed by the GAO report, the Aircraft Certification Service took a fresh look at the oversight of Designated Manufacturing Inspection Representatives and Designated Airworthiness Representatives. These manufacturing inspection designees work side-by-side with the DERs to accomplish our programs. The result of their review is a draft notice titled, "*Designee Supervision, Monitoring, and Tracking.*" It is scheduled to be published soon. The notice provides procedures for assigning duties and responsibilities to manufacturing inspection designees, observing and reviewing their work for accuracy and quality, and documenting all data pertaining to the designee's activities. This documentation will initially reside in the designee's administrative file, but there are efforts underway to automate it.

Delegation Systems

Each of the above efforts provides for oversight and evaluation of individuals who are either designees or who are responsible for monitoring designees. It is generally believed that the ultimate efficiency of delegation may ultimately be served, not only by designating individuals, but also by delegation to organizations. Delegations to individuals and organizations exist to some degree today. The Aviation Rulemaking Advisory Committee (ARAC) Delegation Systems Working Group is charged with reviewing the current system of delegations to perform aircraft certification functions to determine what would improve the safety, will assess the results of the prototype quality and effectiveness of the system, and making recommendations concerning new or revised rules and advisory materials. The FAA Aircraft Certification Service is seeking a comprehensive, up-to-date, systematic approach for delegating aircraft certification functions to both individuals and organizations which is as compatible as practicable with the systems used by the civilian aviation authorities of other countries.

Another area of GAO's recommendation involves measures of staff members' performance and effectiveness. With better guidance on the necessary level and quality of oversight now in place, these measures can be more easily ascertained. We recognize the need to better train our staff to do this oversight work and to formalize performance measures for our staff. The results of this focus will be evident in the annual evaluation of the new DER oversight process.

Designee Management Training

As I mentioned in my testimony, it is important that our employees have the management skills to properly supervise the individuals and organizations that make up our delegation system. To support this need, we are designing training for those technical employees with designee oversight responsibility. This training will be developed during fiscal year 1995 for deployment in fiscal year 1996.

Lastly, GAO recommends identifying critical activities requiring the agency's involvement or oversight. As I stated in my testimony, since no two certification projects are alike in terms of applicant experience or application of technology, it is difficult to identify categories of critical activities that apply to all projects. This determination is better made with respect to each individual project. We believe that work underway in risk assessment methodologies will help us target our resources to maximize our effectiveness. We are also capturing the experience of senior engineers and using it to build training for new employees.

In summary, the Aircraft Certification Service has taken some significant steps in enhancing the oversight of designees. We are particularly pleased that these improvements are being made by those who are most intimately involved with the issues and dynamics inherent in the process: the engineers, pilots and inspectors who work with our designees every day.

-- Anthony J. Broderick

Aging Aircraft Publications

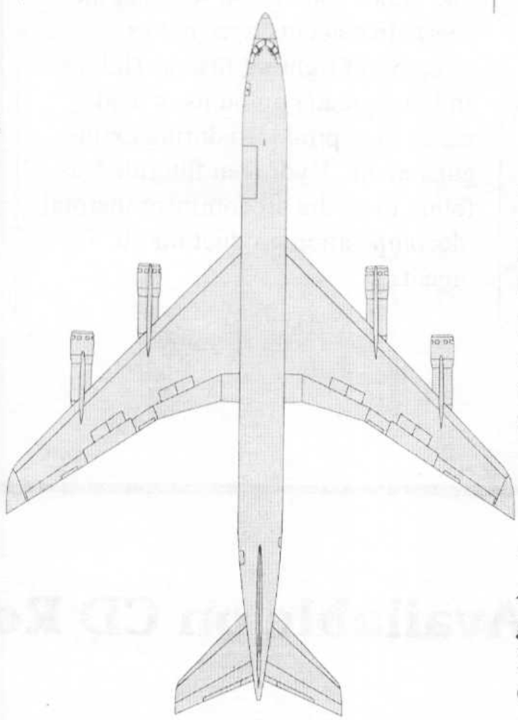
Information for this article came from the "National Aging Aircraft Research Program News," January-March, 1995.

In October 1993, revised ***"Damage Tolerance Handbooks, Vols. I and II,"*** were published by the FAA Technical Center. A video companion to the ***"Damage Tolerance Handbooks"*** is now available. The video provides a brief overview on structural analysis and the damage tolerance philosophy and show the importance of inspection in maintaining aircraft safety with a damage tolerance design.

The video, ***"Nondestructive Inspection for Corrosion Control,"*** Parts 1 and 2, describes the use of nondestructive inspection in detecting corrosion in aircraft structures. Part 1 focuses on techniques currently in use, while Part 2 presents emerging nondestructive inspection techniques that could be used for corrosion detection.

"Nondestructive Inspection (NDI) of Reduced Strength Bonds," DOT/FAA/CT-93/42, February 1994, describes a study done to develop a nondestructive inspection technique capable of detecting weak adhesive bonds.

"An Elastic-Plastic Finite Element Alternating Method for Analyzing Widespread Fatigue Damage in Aircraft Structures," Georgia Institute of Technology, FAA Center of Excellence for Computational Modeling of Aircraft Structures, November 1994, presents the elastic-plastic finite-element alternating method, an analytical technique to study the effect of widespread fatigue damage in ductile panels.



"Residual Strength Predictions for Aircraft Panels with Multiple Site Damage Using the 'EP-FEAM' for Stable Crack Growth Analysis," Georgia Institute of Technology, FAA Center for Excellence for Computational Modeling of Aircraft Structures, November 1994, presents a study of stable crack propagation problems in a ductile panel with a row of cracks using the elastic-plastic finite element alternating method.

"Interaction of Engine Rotor Fragments with Containment Structures," Georgia Institute of Technology, FAA Center for Excellence for Computational Modeling of Aircraft Structures, July 1994, analyzes the dynamic interactions of failed rotor turbine fragments and an aircraft engine casing in the event of a rotor failure.

"Characterization of Corrosion and Development of a Breadboard Model of a D Sight Aircraft Inspection System: Phase I," DOT/FAA/CT-94/56, August 1994, describes the development and testing of a nondestructive inspection technique to detect and characterize corrosion in aircraft fuselage structures.

"General Aviation Individual Airplane Load Monitoring Program," presented at the AIAA/FAA/MSU 3rd joint Symposium on General Aviation Systems, describes the initial phase of the FAA research and development effort to develop a flight load data recording system appropriate for small aircraft.

To obtain any of these documents, contact Pat Walter, (505) 844-5226, or Dennis Roach, (505) 844-6078.

Availability of Reports on Halon Alternatives

The following reports are available from the National Technical Information Service, Springfield, Virginia 22161:

"The Comparative Extinguishment Performance and Thermal Decomposition Products of Halon Alternative Agents," DOT/FAA/CT-94/59, dated December 1994.

Halon 1301, Halon 1211, and eleven alternative fire-fighting agents were compared for extinguishment effectiveness and thermal decomposition product generation, using a laboratory-scale test apparatus having methane as the fuel. Chemical analysis was conducted using a magnetic sector mass spectrometer with simultaneous measurement of oxygen consumption and carbon dioxide, water, and acid gas production. Chemical mechanisms are advanced to explain how halogenated hydrocarbons extinguish fires. The major conclusion was that the alternative agents were not as effective at fighting fires as Halons and that greater amounts of acid gases were produced during extinguishment. Hydrogen fluoride was found to be the predominant thermal decomposition product for all agents.

"Chemical Options to Halon for Aircraft Use," DOT/FAA/CT-95/9, dated February 1995.

This report contains a summary of available fire suppression agents, their properties and applicability in the various aircraft applications. Classes of agents, with presently available agents listed, are recommended for use in the development of test protocols. The test protocol developed for a class of agents can be used, with minor modifications, to test all agents belonging to that class.

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ASRS Database Available on CD Rom

The National Aeronautics and Space Administration's (NASA) internationally recognized Aviation Safety Reporting System (ASRS) incident database is now available on CD ROM. The ASRS CD ROM has tens of thousands of incident reports submitted by air carrier and general aviation pilots, dispatchers, air traffic controllers, and others over the past five years, covering a wide variety of today's aviation safety issues.

ASRS records reference important safety concerns such as pilot fatigue, experience level, advanced technology, airspace conflicts, TCAS, controlled flight toward terrain, flight training, and much more.

The ASRS CD ROM is an important source of aviation human factors data and is an effective professional tool in aviation safety programs and research.

A single disc is $399. An update subscription service is available semi-annually for $699 and quarterly for $1,299.

For more information about the ASRS CD ROM, contact:

Aeroknowledge, Inc.
PO Box 711
Pennington, NJ 08534
telephone: (609) 737-9288.

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Publications and Media

FEDWorld Information

The FAA's Regulatory and Support Division (AFS-600) located in Oklahoma City, has entered into an agreement with the National Technical Information Service (NTIS) to provide electronic information on a BBS (FEDWorld) to FAA users as well as the general public. There is no charge for anyone to access this BBS except for normal long-distance telephone connect charges.

This BBS has been designated by AFS-600 as the BBS that will contain the most current information relating to time-critical safety data.

What is currently available on FEDWorld in the FAA Safety Data library:

- Service Difficulty Reports (weekly files).
- Pilot testing information.
- Advisory Circular (AC) 183.29.1CC, Designated Engineering Representatives (consultants).
- Full text of Federal Aviation Regulations (FAR), Parts 1 through 199.
- Current Notices of Proposed Rulemaking (NPRM) and Final Rules as published in the **Federal Register.**
- NPRM's for Airworthiness Directives (AD) as published in the **Federal Register**.
- New FAA Order - 8110.4A, Type Certification Process.
- Current month's issue of General Aviation Alerts.

Information to be available on FEDWorld in the near future:

- Master Minimum Equipment Lists (MMEL's).
- All Flight Standards Advisory Circulars.

How to connect to FEDWorld:

FEDWorld may be reached by connecting via modem with telephone number (703) 321-8020. Set communications software to show:

- modem parity - **none**,
- data bits - **8**,
- stop bit - **1**,
- terminal emulation - **ANSI**, and
- duplex - **full**.

To connect through the Internet, telnet to **fedworld.gov** (192.239.92.201). For file transfer protocol (FTP) services, connect to **ftp.fedworld.gov** 192.239.92.2050.

After setting up your software, connect, enter "new" and follow the prompts. After you enter your name and a password, select "**U**" for utilities/files/mail, "**F**" for file libraries, and "**S**" for select a library. At the prompt enter "**FAA**" for the FAA Library (FAA Safety Data). The BBS is menu-driven and user friendly.

Airworthiness Directives are available on a fee-based BBS at FEDWorld. For further information, contact **Ms. Lynn Hutcherson**, AFS-613, telephone number (405) 954-6896.

For FEDWorld connectivity assistance, contact their help desk at (703) 487-4608.

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In Memorium

Wyatt Ingram (1959 - 1994)

A crash 30 miles northeast of Van Horne, Texas, on December 27, 1994, took the life of test pilot and engineer **Wyatt C. Ingram** and his wife **Michele**. The airplane, a Comanche 250, was piloted by Wyatt and was returning from a Christmas holiday in California. The accident occurred in the southern Guadeloupe Mountains while the airplane was descending into Pecos, Texas.

In recent years, Wyatt had worked under the company name of Aerosmith, providing engineering, flight test pilot, flight analyst, and certification services to general and commercial aviation companies. Wyatt's latest programs included flight analyst work on the Dee Howard Quiet Freighter, as well as flight testing of the Swearingen SJ30, the Marsh Aviation S-2E Turbotracker, and extensive certification flight test and flight analyst work on the Mooney Aircraft Ovation and the Commander 114TC.

After leaving Georgia in 1986, where he was a graduate of Texas A&M University, Wyatt joined LACADRE in Chatsworth, California. As Engineering Manager, he directed the company activities in the Valsan 727 re-egining program, as well as the flight test and certification of the Basler Turboprop DC-3. During this time, he earned a Designated Engineering Representative - Flight Analyst certification from the FAA. After the successful certification of the Turboprop DC-3, the Ingram's returned to Texas where Wyatt took the reins of the Aerodis America, Inc., development programs. As Engineering Manager and Head of Flight Test, Wyatt directed all development activities on the AA200 (a four-seat, pusher engine aircraft) and the AA300 (a tandem jet trainer). After completion of the design and building of the prototype aircraft, Wyatt executed a perfect first flight on the AA200 on April 7, 1991.

One of the achievements that Wyatt was most proud of were the three NAA-sanctioned record flights that he and Bill Walker made in the Marsh Turbotracker in August 1993. These records still stand today: speed over 100 kilometers (282 mph), time to climb to 3,000 meters (9,843 ft.: 3.66 minutes), and maximum altitude (35,735 ft.).

Wyatt had in excess of 2,500 hours in the cockpit flying a variety of aircraft, from the T-38 to the DC-3. Although he had many hours in large aircraft, his passion remained general aviation.

Wyatt's departure at age 35 is a profound loss that leaves a large void in the future of aviation design. "Wyatt had a tremendous future as a test pilot ahead of this," was a statement from well-known test pilot and former president of Gulfstream, Corwin (Corky) Meyer. "His loss will be felt by all of us in the industry."

The Third Annual Air Show in Llano, Texas, founded by Wyatt, took place on March 25, 1995, and was dedicated to Wyatt and Michele. A memorial fund has been established in Wyatt and Michele's name; information is available by calling (915) 247-4300.✠

Boeing 777

Continued from page 5

flight, thrust and communication management.

The flight crew transmits control and maneuvering commands through electrical wires, augmented by computers, directly to hydraulic actuators for the elevators, rudder, ailerons, and other control surfaces. This three-axis *"fly-by-wire"* flight control system saves weight, simplifies factory assembly compared to conventional mechanical systems relying on steel cables, and requires fewer spares and less maintenance in airline service.

A key part of the 777's systems is a Boeing-patented two-way digital data bus, which has been adopted as a new industry standard: ARINC 629. It permits airplane systems and their computers to communicate with one another through a common wire path (a twisted pair of wires) instead of through separate one-way wire connections. This further simplifies assembly and saves weight, while increasing reliability through a reduction in the amount of wires and connectors. There are 11 of these ARINC 629 pathways in the 777.

*The Transport Airplane Directorate thanks **Douglas Webb**, Manager of the Communications Department of Boeing's 777 Division, for the material for this article.*

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Ice Protection

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The FAA is considering a public meeting to address inadvertent encounters with and limited operation in icing conditions which exceed those characterized by Appendix C of part 25. These conditions would include large supercooled droplets. We would appreciate any observations from the manufacturers on such a meeting.

This effort is a joint program involving both the Small Airplane Directorate and the Transport Airplane Directorate.

For more information on this effort as it relates to part 25 airplanes, contact **Bob McCracken**, Flight Test and Systems Branch (ANM-111), Transport Airplane Directorate, at telephone (206) 227-2118.

For more information on this effort as it relates to part 23 airplanes, contact **John Dow**, Project Support Office (ACE-112), Small Airplane Directorate, at telephone (816) 426-6932.✠

Cyberspace

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Cyberspace data monitoring software has been installed in JPL's mission operations center and is being evaluated using real data from the Magellan, Voyager 1, and Voyager 2 spacecraft. Data from all three missions can be displayed in a single window and many more space flight missions could be added to the system.

The software is also in the process of being installed at Kirtland Air Force Base at the Phillips Lab Payload Operations Center in Albuquerque, New Mexico, for the TAOS (Technology for Autonomous Operational Survivability) mission. In addition, the software is becoming increasingly popular within the Air Force. A version of the program that displays data from TAOS, the Miniature Seeker Technology Integration (MSTI-II) mission and other satellite missions was demonstrated in November at Onizuka Air Force Base in Sunnyvale, California.

The cyberspace interface is being developed as a generic monitoring application that will be versatile and applicable to a variety of ground-based industrial uses, such as monitoring levels of radiation in nuclear power plants or levels of toxicity at chemical waste sites.

"The software clearly allows considerable flexibility in selecting the classification and level of detail to be used for routine monitoring of data," Dr. Schwuttke noted. "Cyberspace monitoring interfaces can also work as a companion piece to other data processing tools for more detailed data visibility."

Development of the Cyberspace Data Monitoring System is being carried out with funding from the U.S. Air Force and the JPL Multimission Operations Systems Office for NASA's Office of Space Science.

[NOTE: An image depicting a display screen from the cyberspace system is available from JPL's public access site via anonymous file transfer protocol (FTP) to **jplinfo.jpl.nasa.gov.** The files, in the directory news, include a browse version CYBER.GIF and a full-resolution (3.5-megabyte) version, P45068.TIF. The files are also available via JPL's World Wide Web page, http://ww.jpl.nasa.gov.]

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Designee Seminars

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Certification Privileges. Scheduled class times are 8:00 a.m.-5:00 p.m.

The Designated Alteration Station Seminar is a two-day (16 hour) seminar now offered to representatives of repair stations and manufacturers who hold a Designated Alteration Station (DAS).

The new schedule information has not been published yet; however, an interim tentative schedule is available through your local FAA Office.

A registration fee of $60 per day for all seminars must be paid prior to attending. Arrangements for payment of tuition to these seminars may be made by mail or telephone. There will be no arrangements for payment at the door.

All persons wishing to attend a seminar should register at least 30 days prior to the scheduled meeting date.

The toll free number for registration is:

800-862-4832

The mailing address is:

Transportation Safety Institute
ATTN: Christina Brooks, DTI-100
P.O. Box 25082
Oklahoma City, OK 73125

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Challenge 2000

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comprehensive review and evaluation of the FAA's regulation and certification responsibilities. They include rapid advances in technology, the need to update the nation's aviation regulatory framework, the introduction of computerized management systems and new business practices, and the United States' responsibilities for international cooperation as the world leader in aviation regulation and certification.

Hinson stressed that *CHALLENGE 2000* is not aimed at a specific problem or intended to bring a predetermined result. Instead, he said, it's an effort to avoid future problems by applying "breakthrough thinking" to regulation and certification.

"I can't predict exactly what this review will tell us, but I believe it will provide the information and the tools we need to chart a true course from where we are now to where we need to be in the future," Hinson said.

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